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HVLF-1 CALIBRATION DATA. (U)
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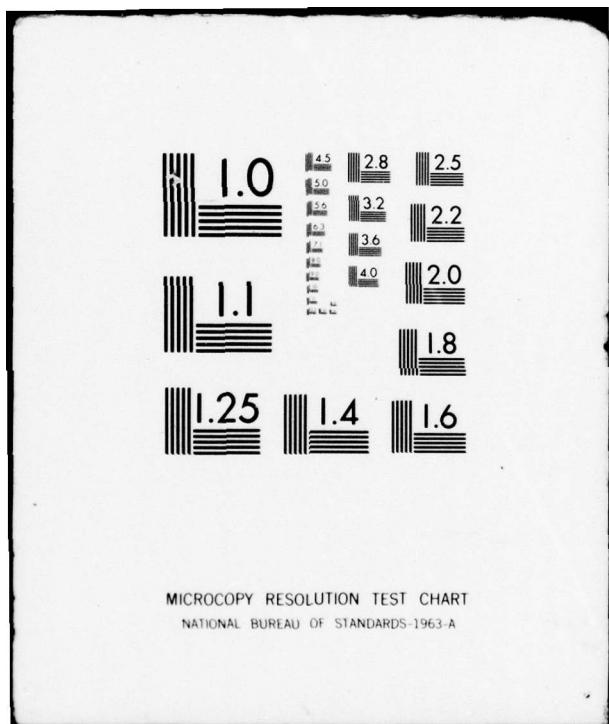
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N00039-76-C-0461
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Report No. HA-105-78

6 HVLF-1
CALIBRATION DATA

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REF ID: A
APR 24 1978

Submitted to:
Naval Electronic Systems Command
Code ELEX 3203
PME 124-62

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1.0 INTRODUCTION

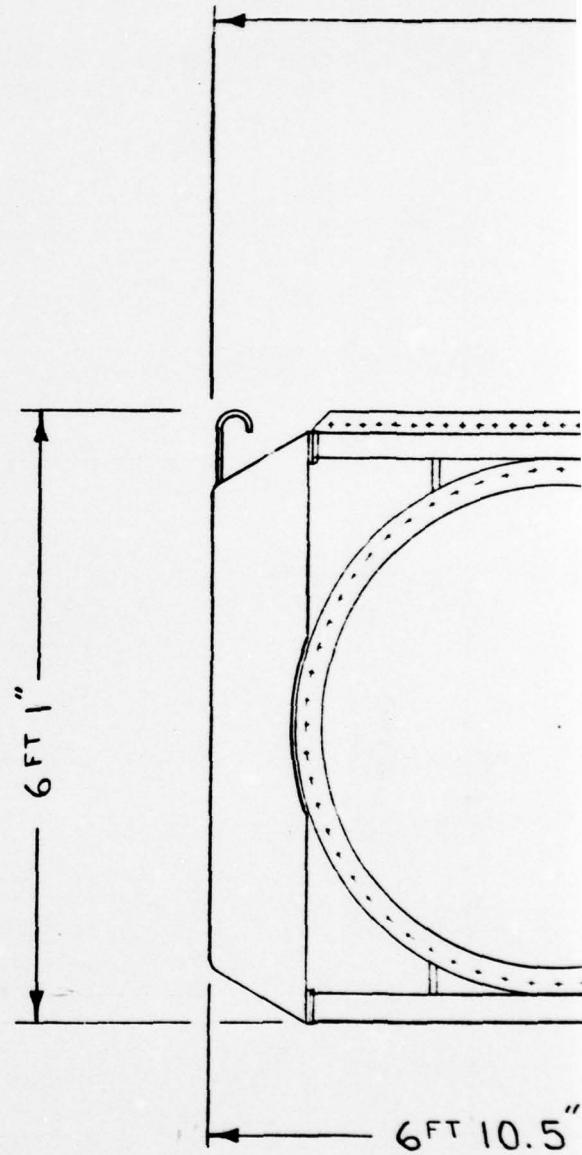
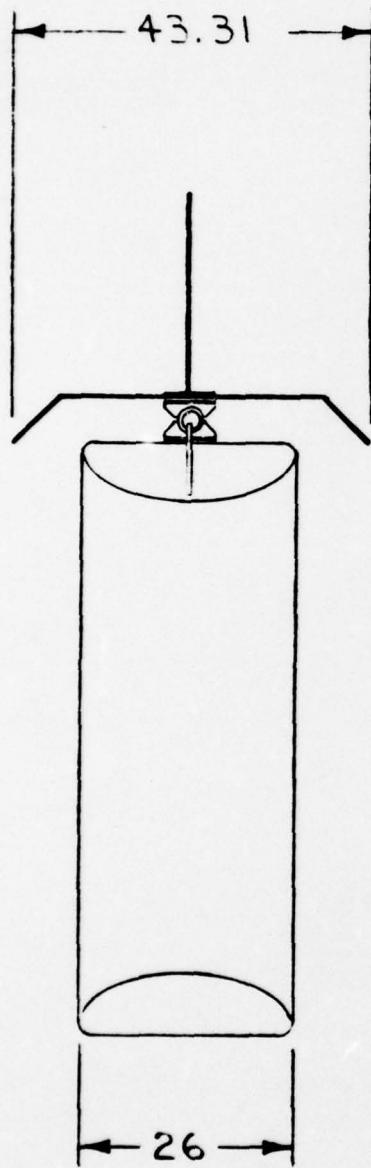
→ The HVLF-1 acoustic source was developed for NAVELEX Codes 320 and PME-124 under Contract N00039-76-C-0461. The source is incorporated in a tow body whose outline dimensions are illustrated in Figure 1.1. The principal characteristics of the source are listed in Table 1.

After 160 hours of nearly non-stop operation in the laboratory, the source was taken to NUSC's calibration facility at Seneca Lake where an additional 130 hours of operating time was accumulated. The only service required on the source during this total running time was a filter change at 135 hours. This report summarizes the results of the Seneca Lake calibration.

→ The source includes its own 30-hp hydraulic power supply as well as instrumentation to monitor source level, radiator acceleration (a signal output monitor), sea water temperature, depth, pitch and roll. Additional performance and diagnostic monitoring functions, including supply pressure, oil flow, main stage pressure, first stage pressure, internal pressure, oil temperature, motor temperature, filter condition and leak indicator are also provided.

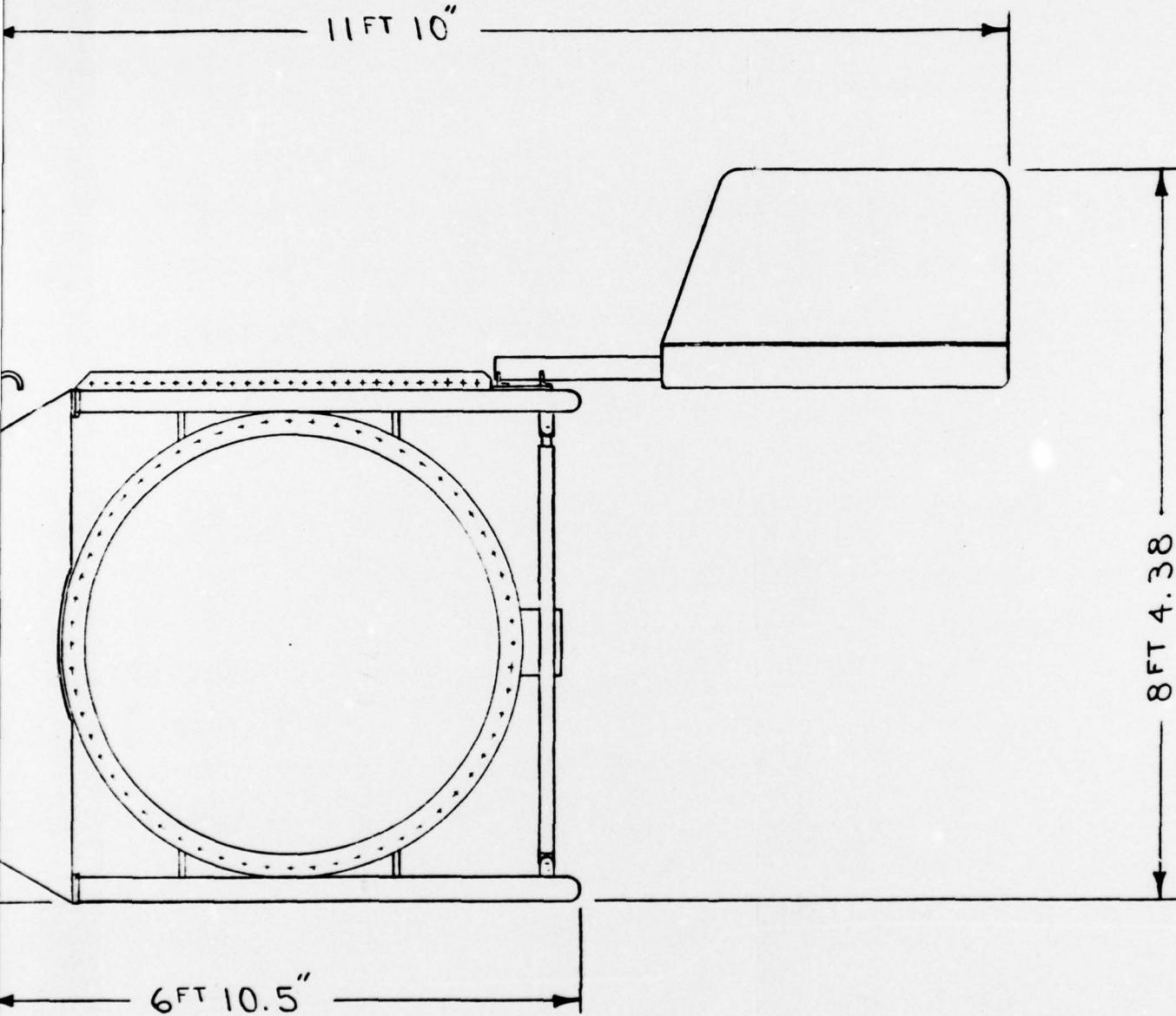
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APPLICATION			

Report No. HA 105-78



ES GOVERN INCLUDING RILLED	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON XX DEC XXX DEC ANGLES \pm \pm \pm	CONTRACT NO.	HYDROACOUSTICS INC. 321 NORTHLAND AVE. P.O. BOX 3818 ROCHESTER, N.Y. 14610				
		DRAWN <i>W. Hovey, Mar 18, 1977</i>	Figure 1. HVLF-1 Towbody Outline				
	MATERIAL	CHECKED					
		ENGINEER					
SED ON ON	UNREL	REL ENGRG	REL FINAL	DESIGN ACTIVITY APPROVAL	SIZE B	CODE IDENT NO. 2117B53306	DRAWING NO.
					SCALE 3/64	1-2	SHEET 2

Table 1
HVLF-1 Parameters

Source Level, dB re 1 uPa @ 1 m	182
Frequency Range, Hz	8-32
Weight, with Tow Body (in Air) lb	5000
Weight, with Tow Body (in Water) lb	2400
Maximum Operating Depth (Uncompensated) ft	300
Input Power, 460 V, 3 Ø, 60 Hz	30 kW

2.0 CALIBRATION RESULTS

2.1 RESPONSE

Figure 2.1 illustrates frequency response data from 6 to 60 Hz at six different drive levels, +3, 0, -6, -12, -18, and -24 dBV. Note that although the source saturates near 0 dBV drive, its response is quite linear below that level over most of the band. Figure 2.2 illustrates the response to a one-volt rms input signal to 200 Hz.

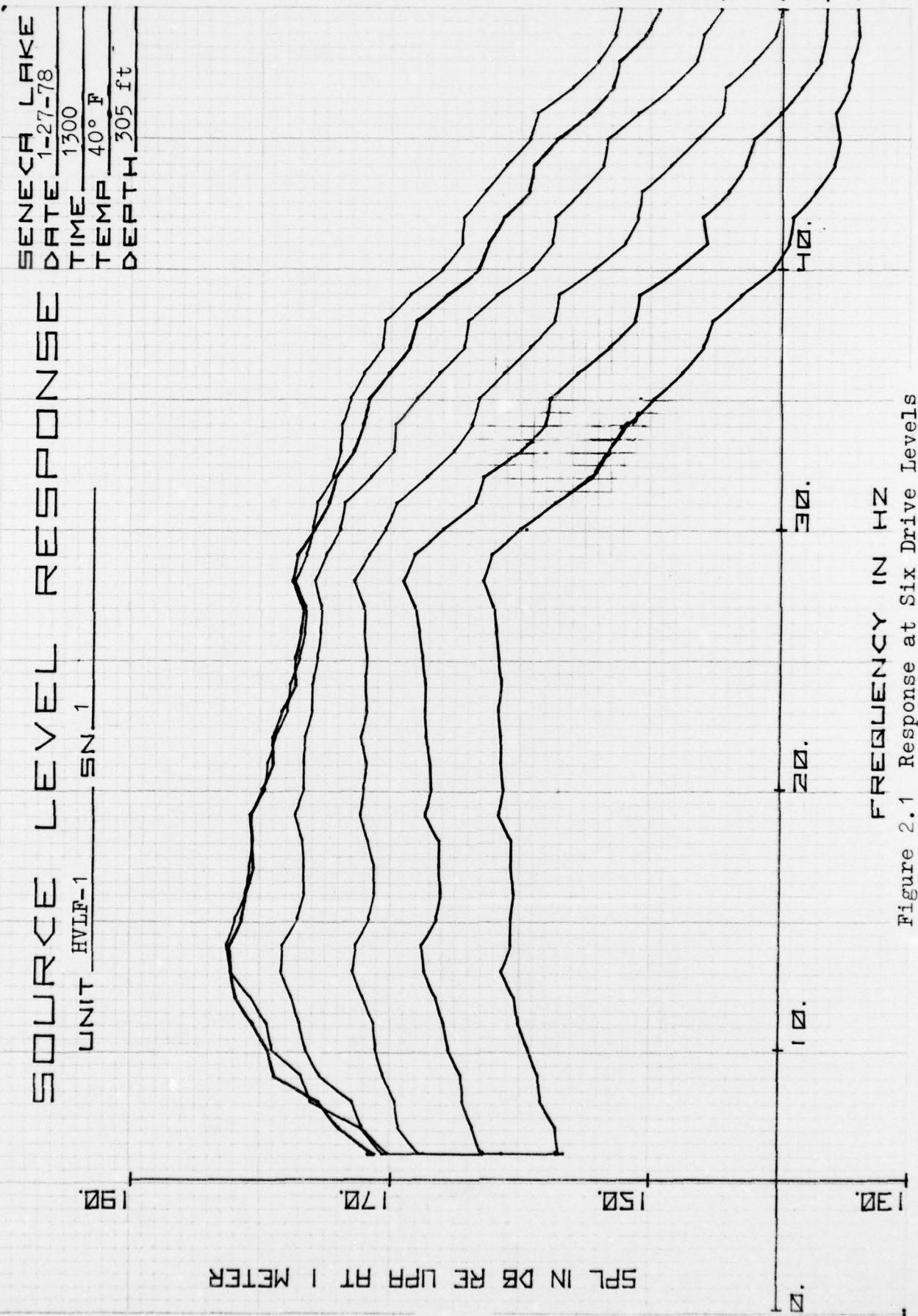
Figure 2.3 is a repeat of Figure 2.1 at the one-volt drive level except that the Monitor Hydrophone (displaced -10 dB) and accelerometer outputs are also plotted. Note that both monitor signals are in excellent agreement with the far-field hydrophone data.

Figure 2.4 repeats the accelerometer data of Figure 2.3 and adds the acoustic pressures within the source; main stage pressure is the pressure driving the radiators, and the first stage pressure is the acoustic pressure driving the main stage valve. The reason for the saturation between 18 and 30 Hz is apparent in Figure 2.4 since the main stage pressure is seen to approach a 1050-psi peak which is a modulation coefficient of the main stage hydroacoustic amplifier of 100%.

2.2 DIRECTIVITY

Figures 2.5 through 2.7 are polar patterns in the horizontal plane at 10, 20, and 100 Hz. No significant deviation from omnidirectionality is apparent in these frequency ranges.

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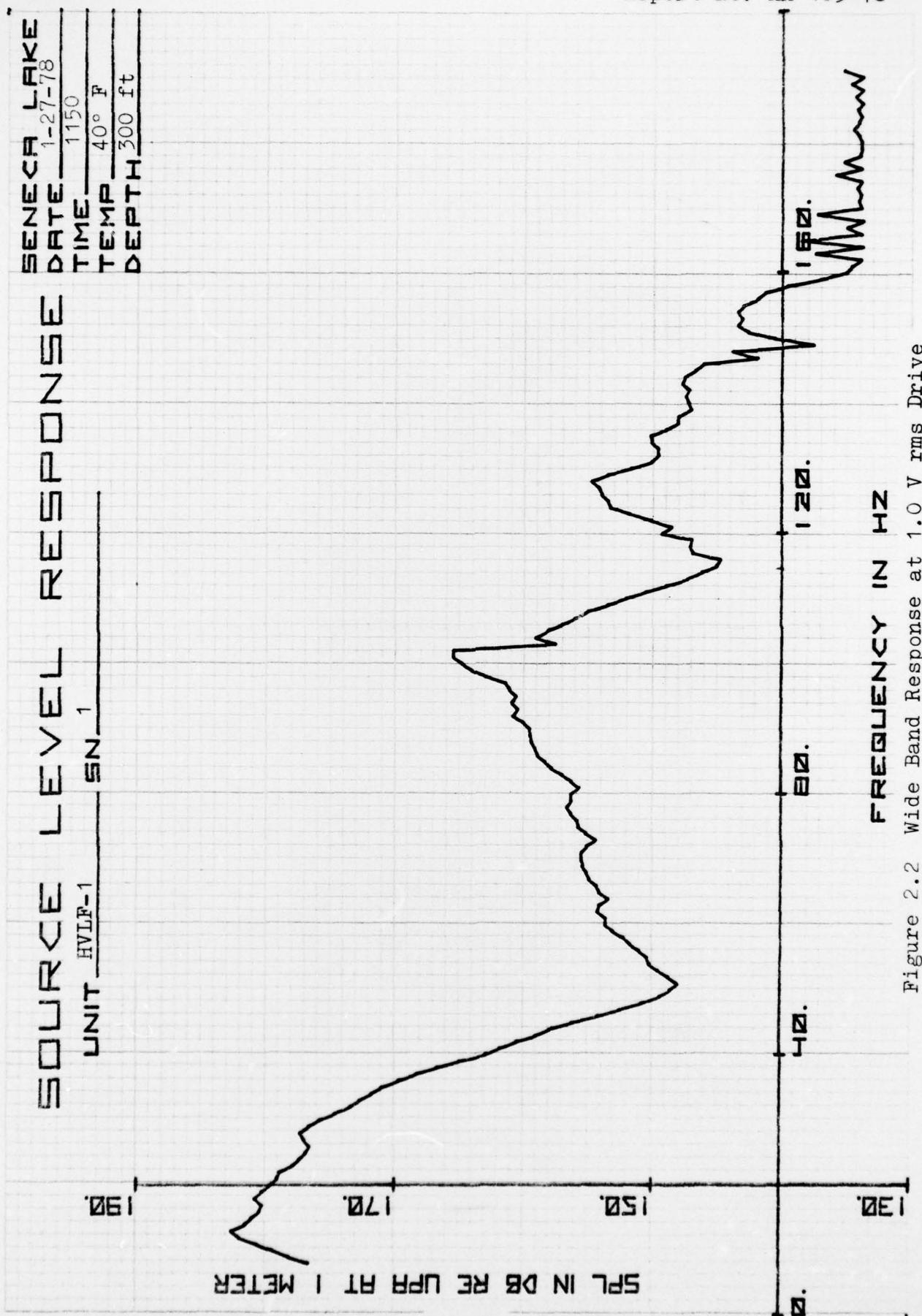


Figure 2.2 Wide Band Response at 1.0 V rms Drive

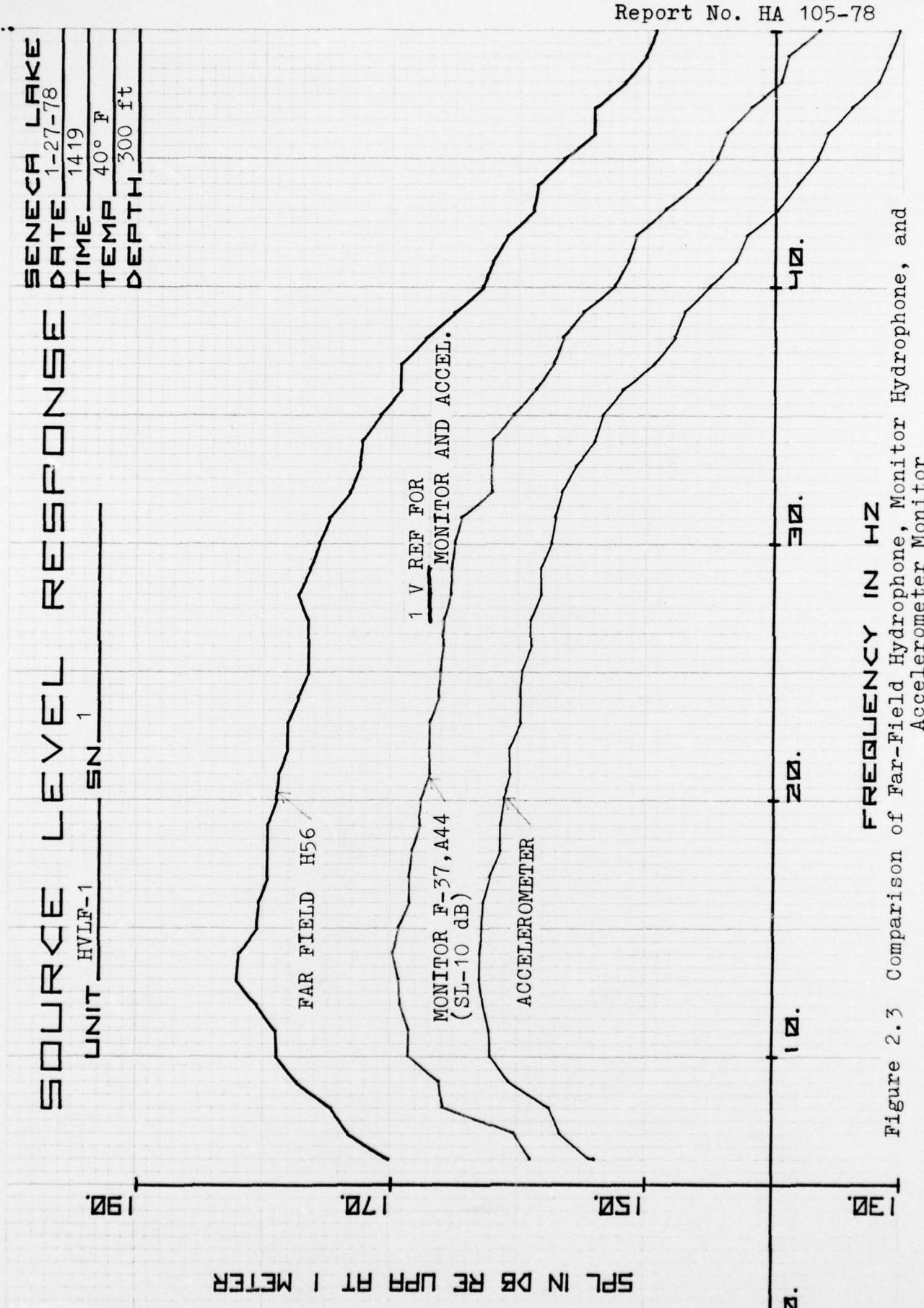


Figure 2.3 Comparison of Far-Field Hydrophone, Monitor Hydrophone, and Accelerometer Monitor

SENeca LAKE
DATE 1-27-78
TIME 1430
TEMP 40° F
DEPTH 305 ft

UNIT HVLF-1 **SN** 1

PRESSURE SIGNAL SCALE: $1 \text{ V} = 1000 \text{ psi}$
ACCELEROMETER SCALE: $1 \text{ V} = 1.37 \text{ g's}$

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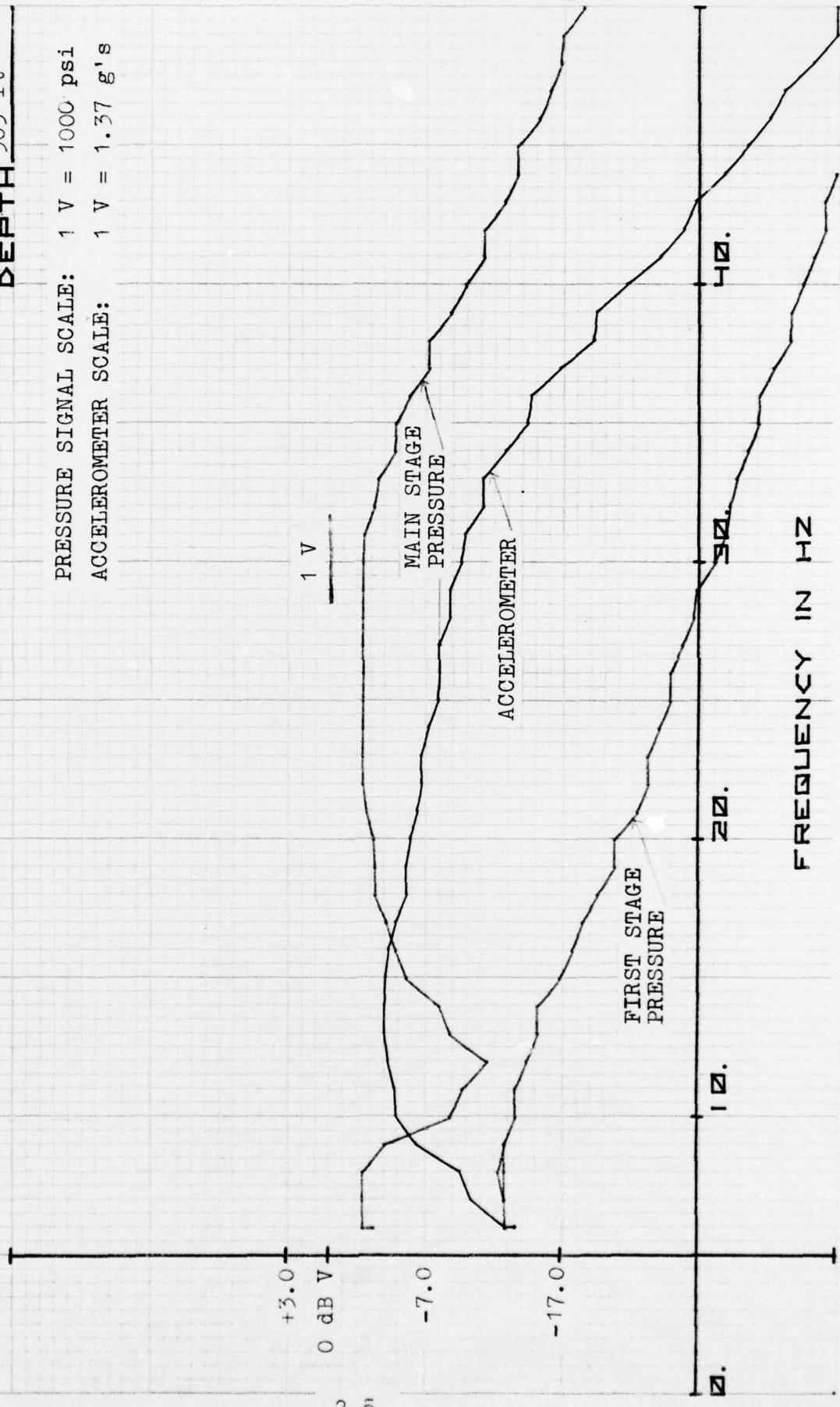
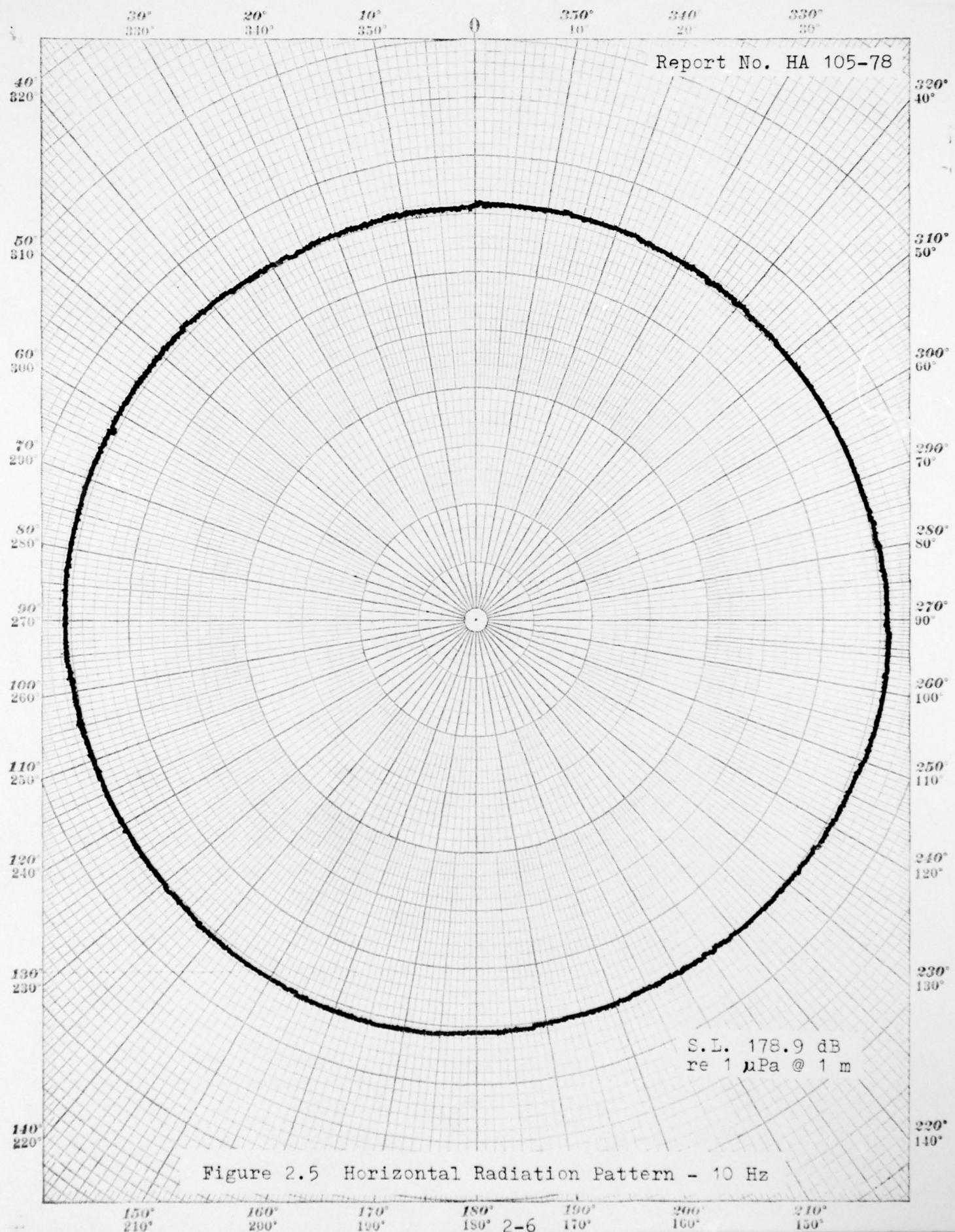
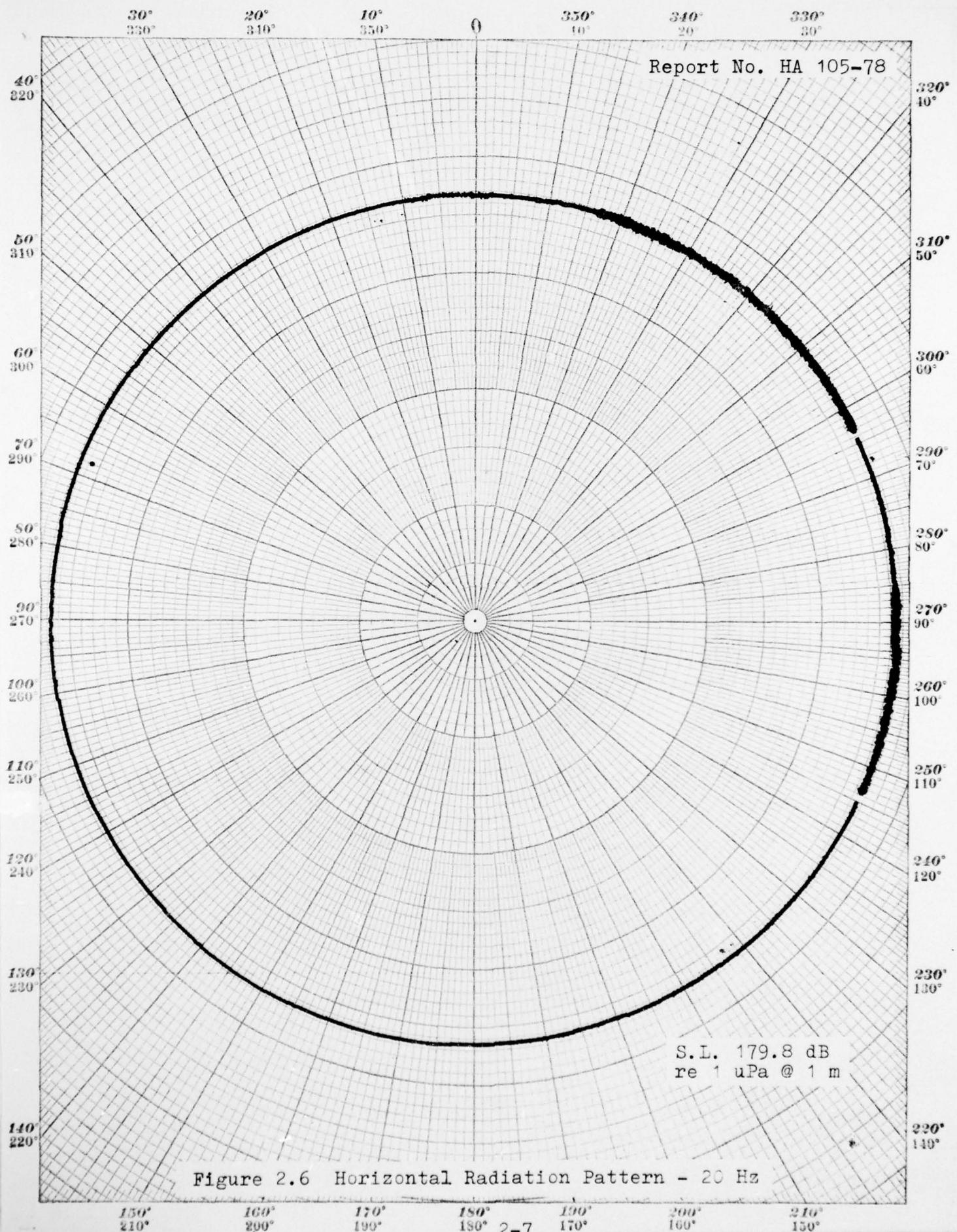
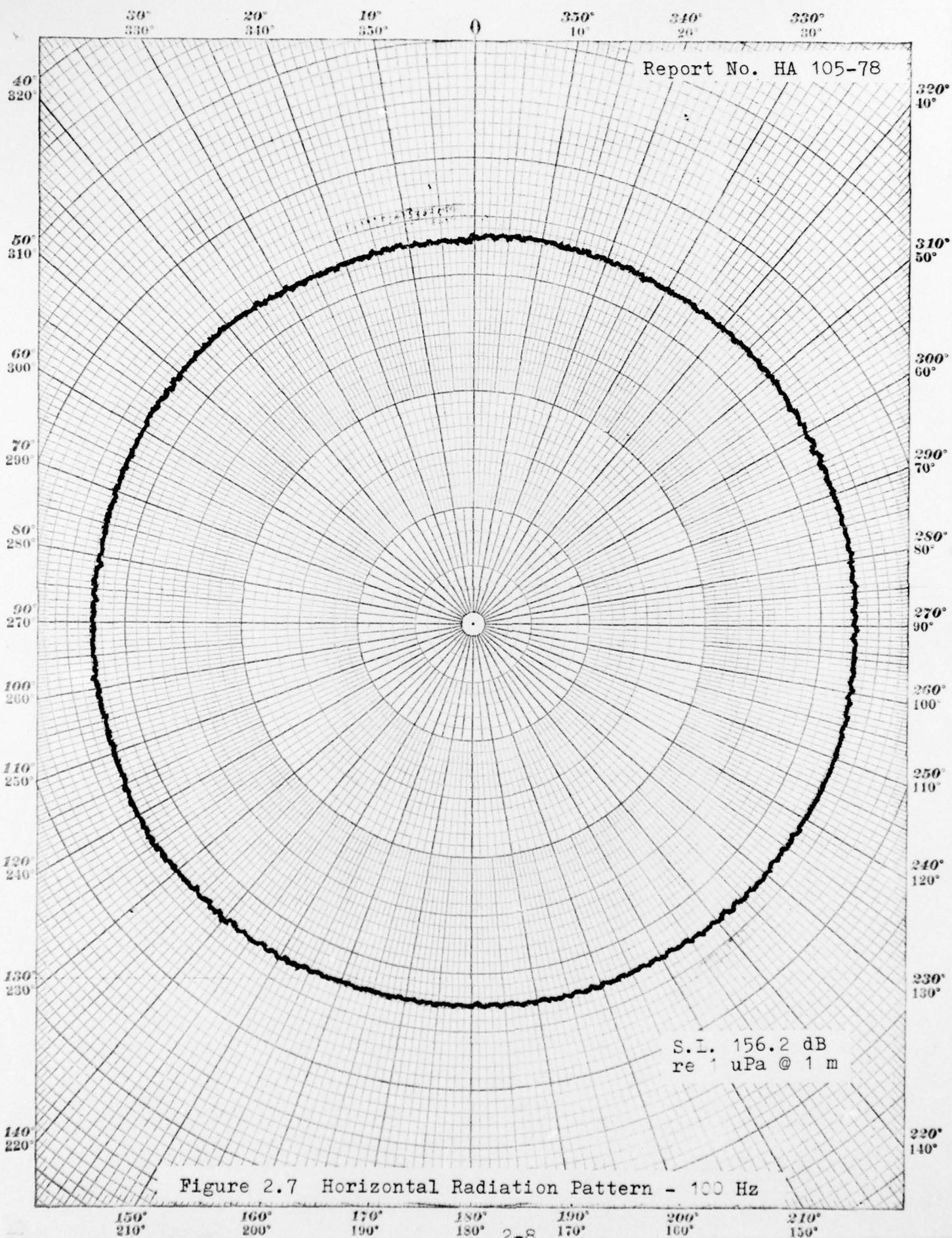


Figure 2.4 Accelerometer and Hydraulic Signal Levels







2.3 OUTPUT SPECTRA

Figures 2.8 through 2.21 are spectra of the source acoustic signal from 0 to 200 Hz taken in the far field. The spectra were collected from 6 to 32 Hz in two Hertz increments.

2.4 ADDITIONAL DATA

Mr. David Diehl of NRL collected cross correlation data of bi-phase and quadrature phase modulated signals of several bandwidths and center frequencies. The fidelity of transmission of these signals was generally excellent and will be reported separately by Mr. Diehl.

Additional point by point data were collected by Western Electric personnel and are included as Appendix A.

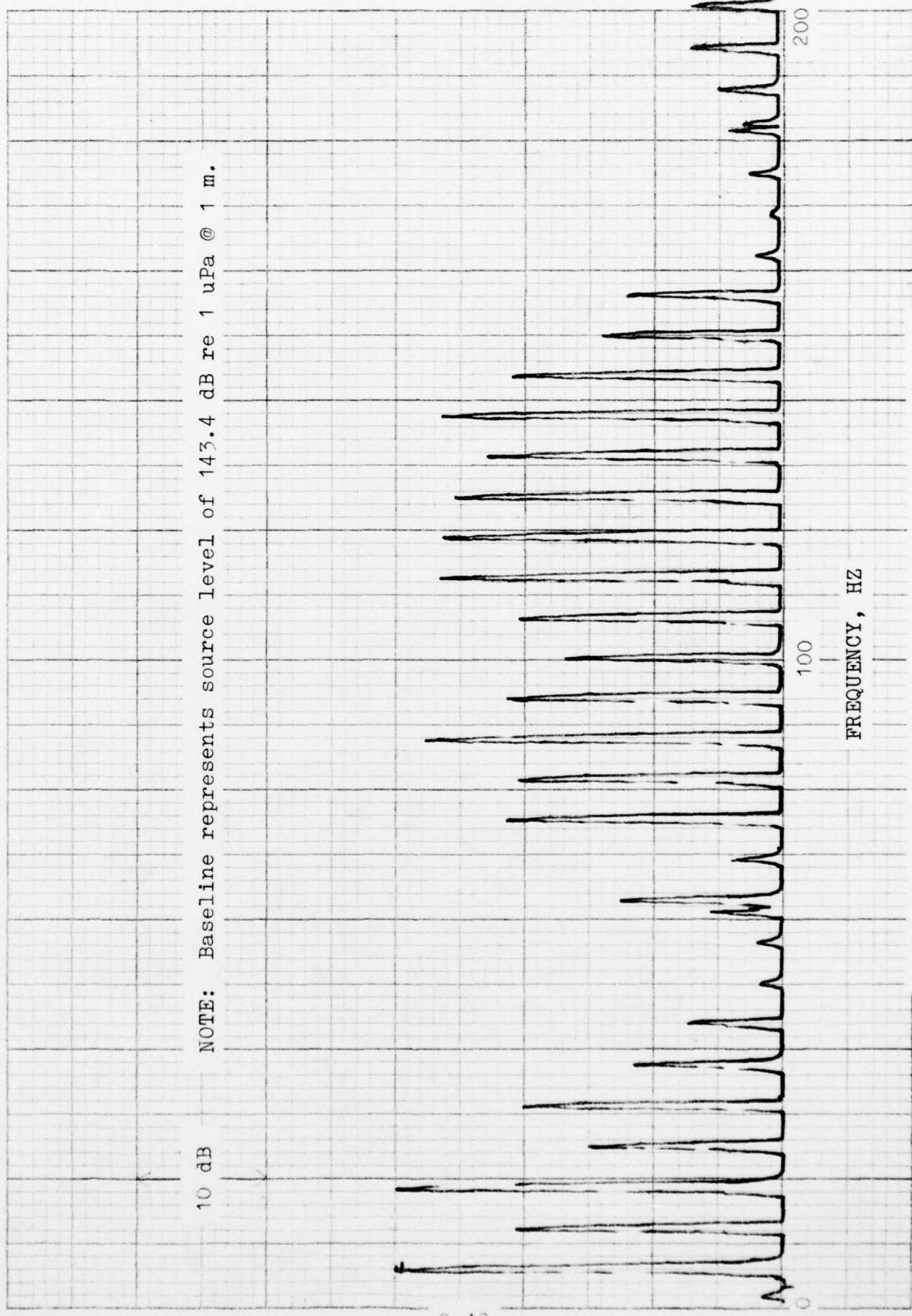


Figure 2.8 Output Spectrum, 1 V rms Drive at 6 Hz

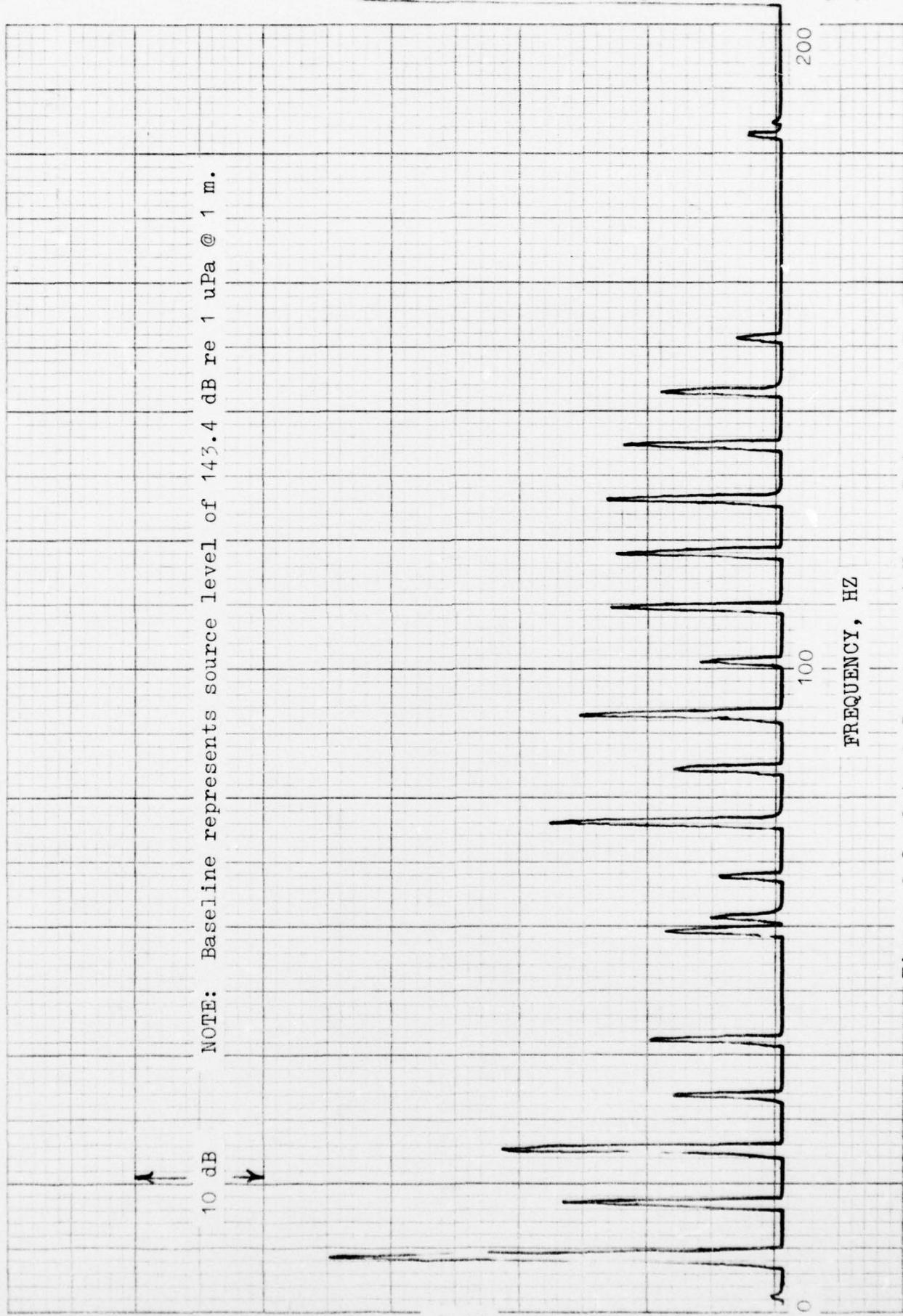


Figure 2.9. Output Spectrum, 1 V rms Drive at 8 Hz

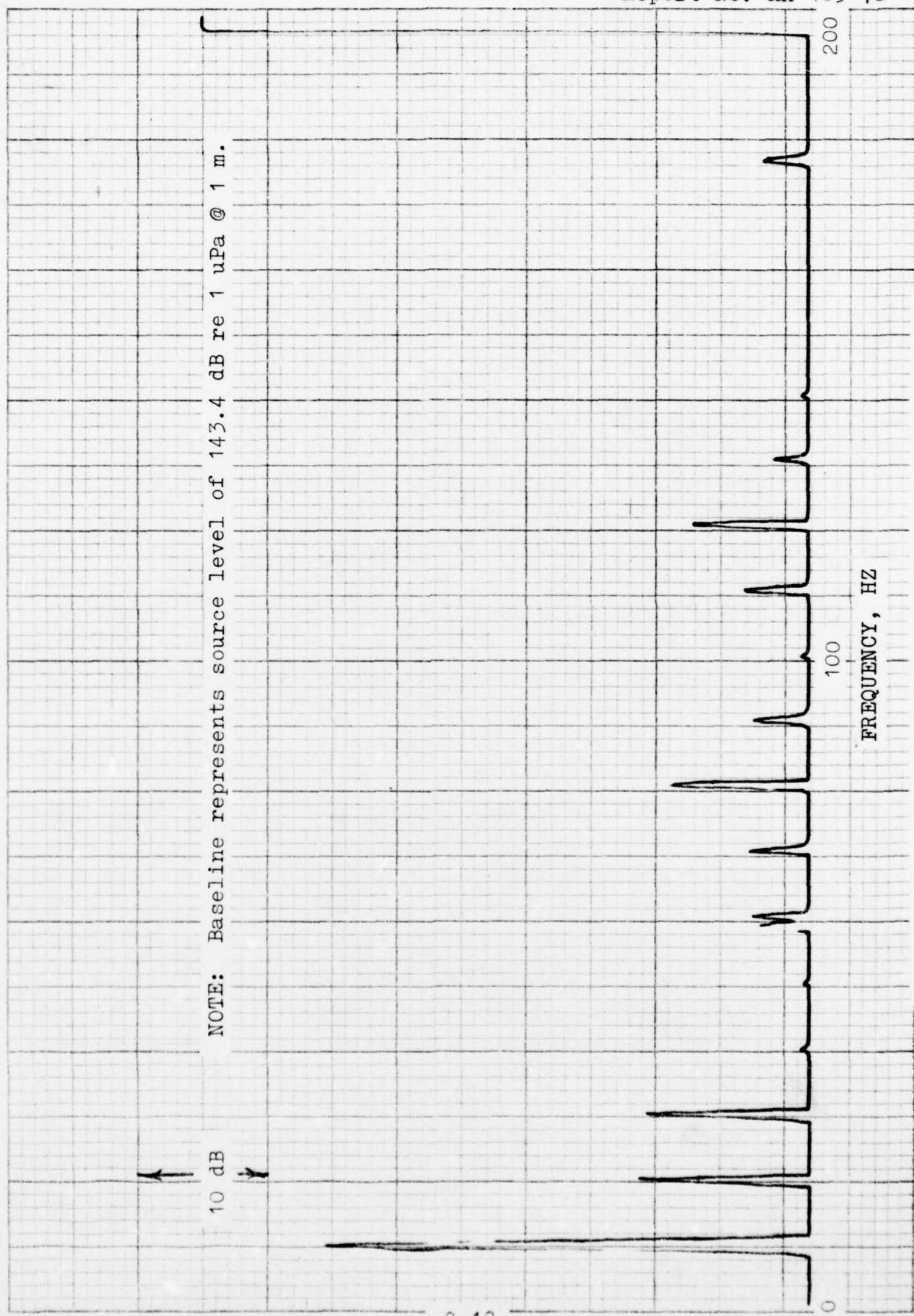


Figure 2.10 Output Spectrum, 1 V rms Drive at 10 Hz

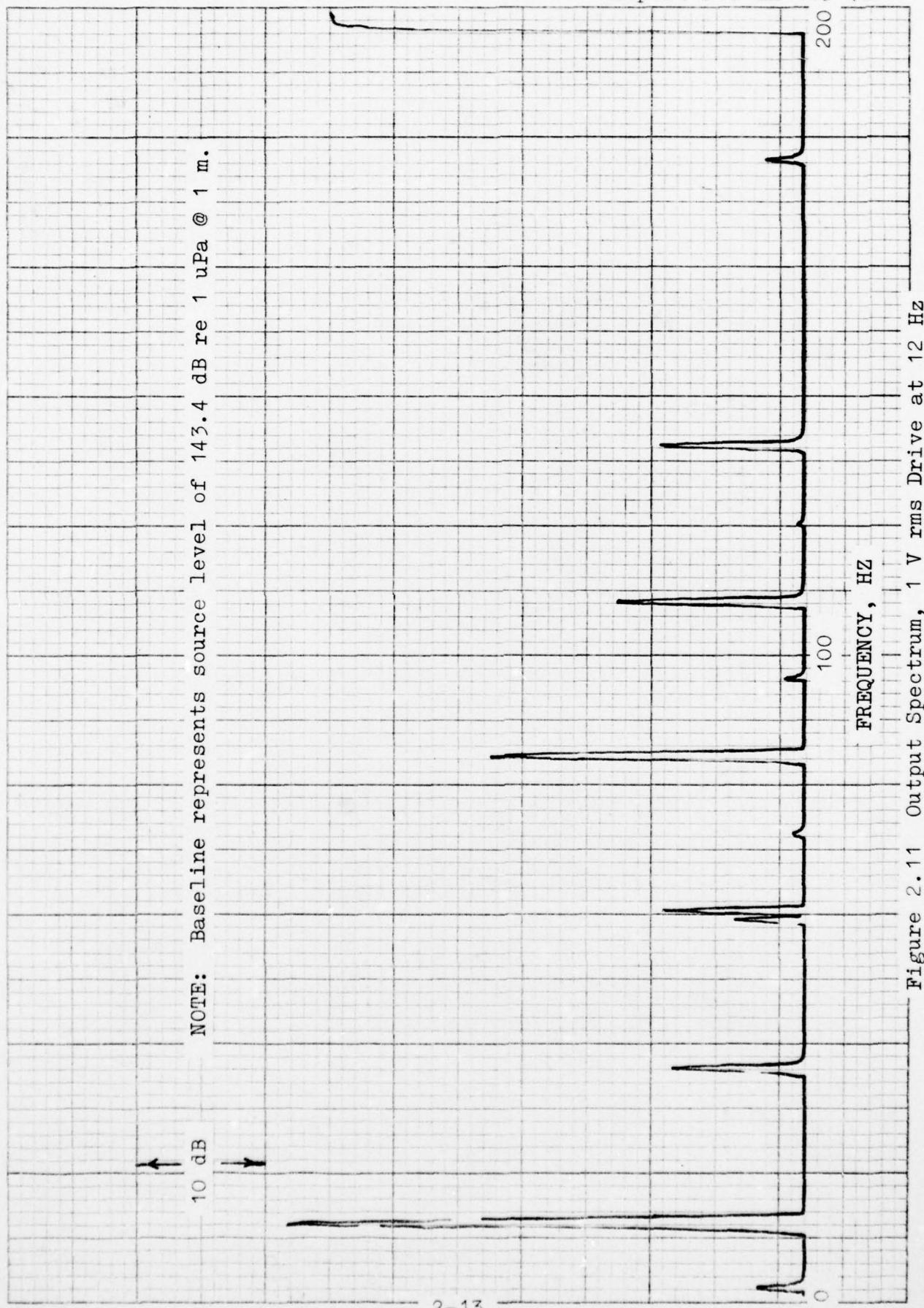


Figure 2.11 Output Spectrum, 1 V rms Drive at 12 Hz

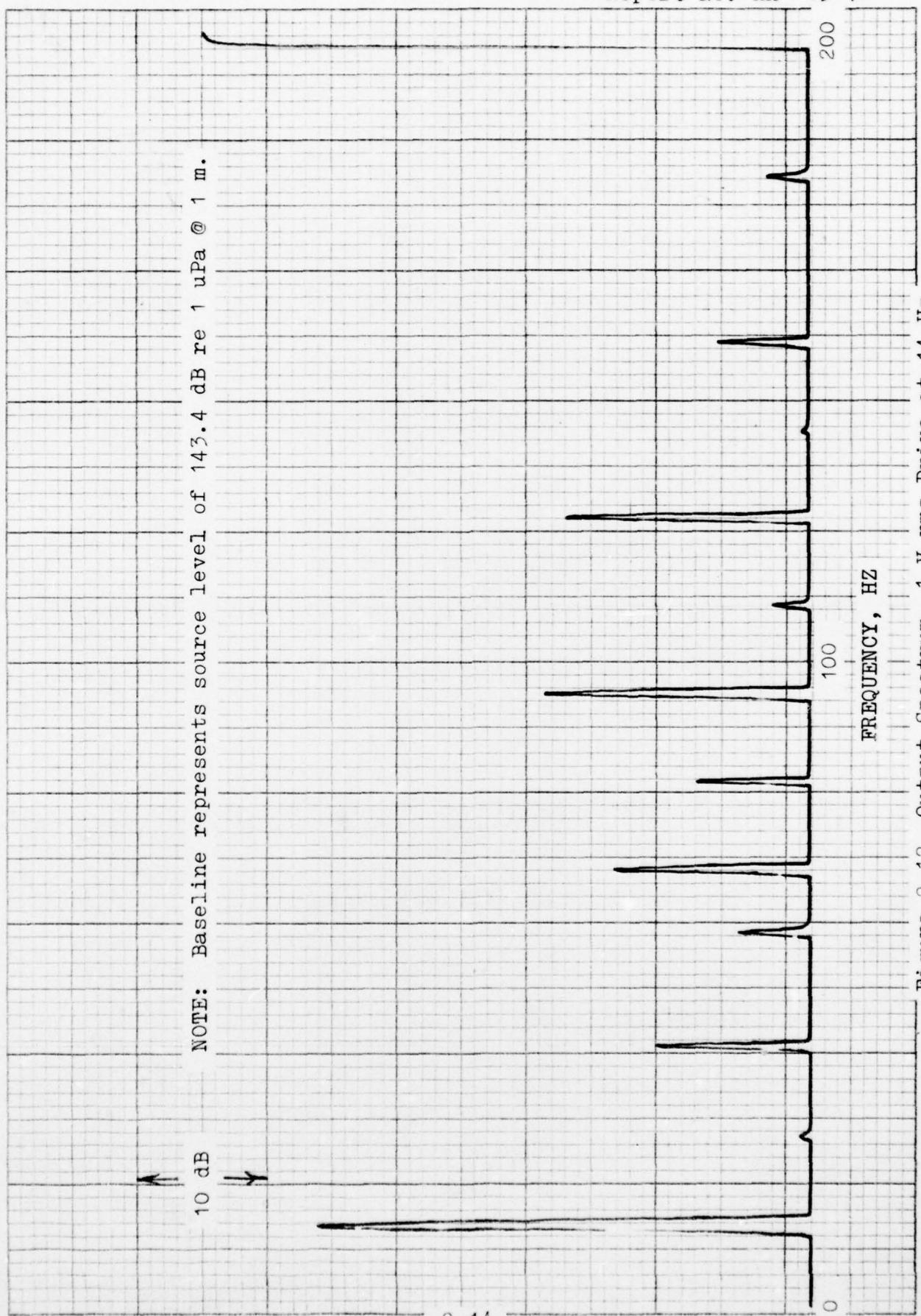


Figure 2.12 Output Spectrum, 1 V rms Drive at 14 Hz

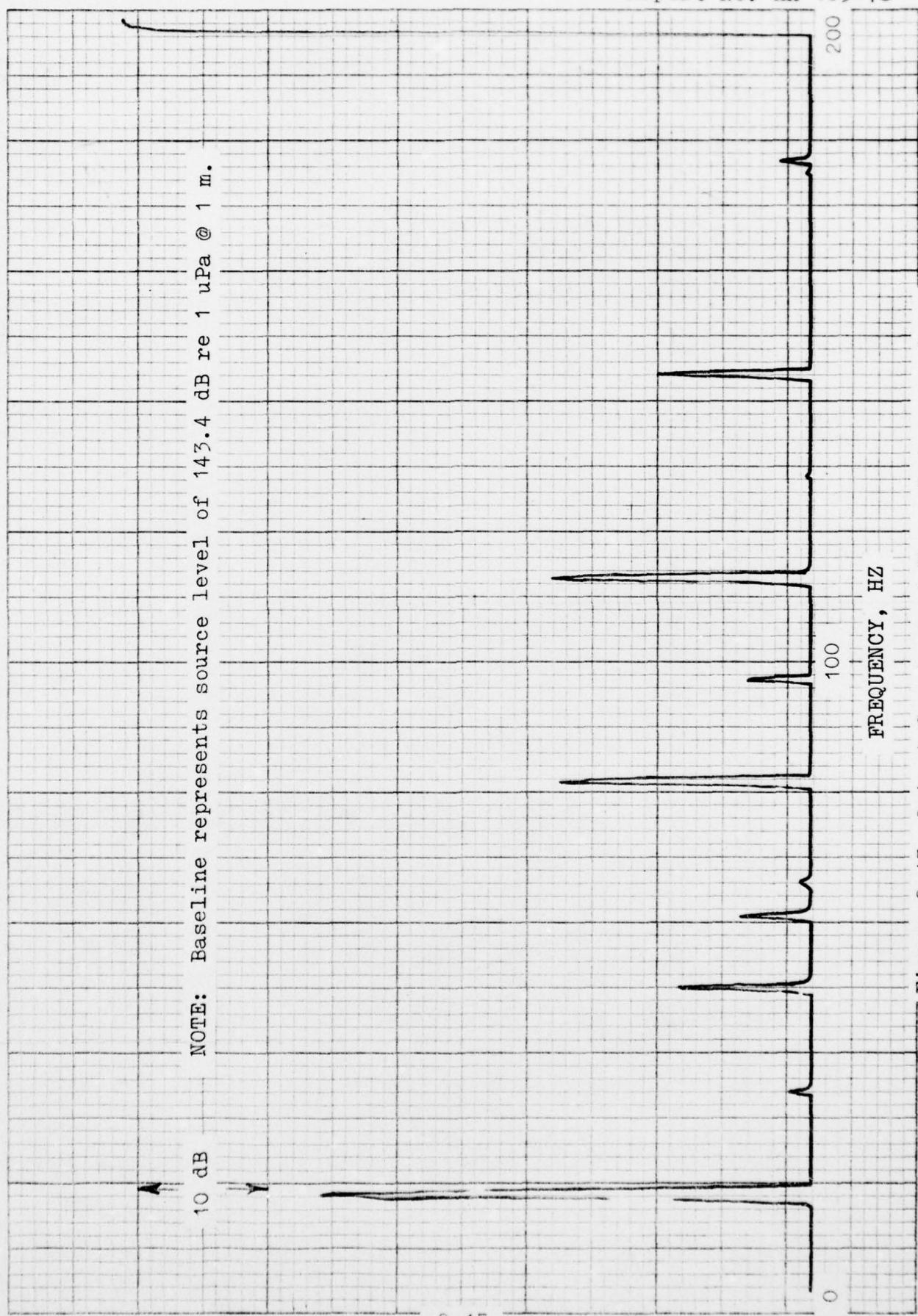


Figure 2.13 Output Spectrum, 1 V rms Drive at 16 Hz

NOTE: Baseline represents source level of 143.4 dB re 1 uPa @ 1 m.

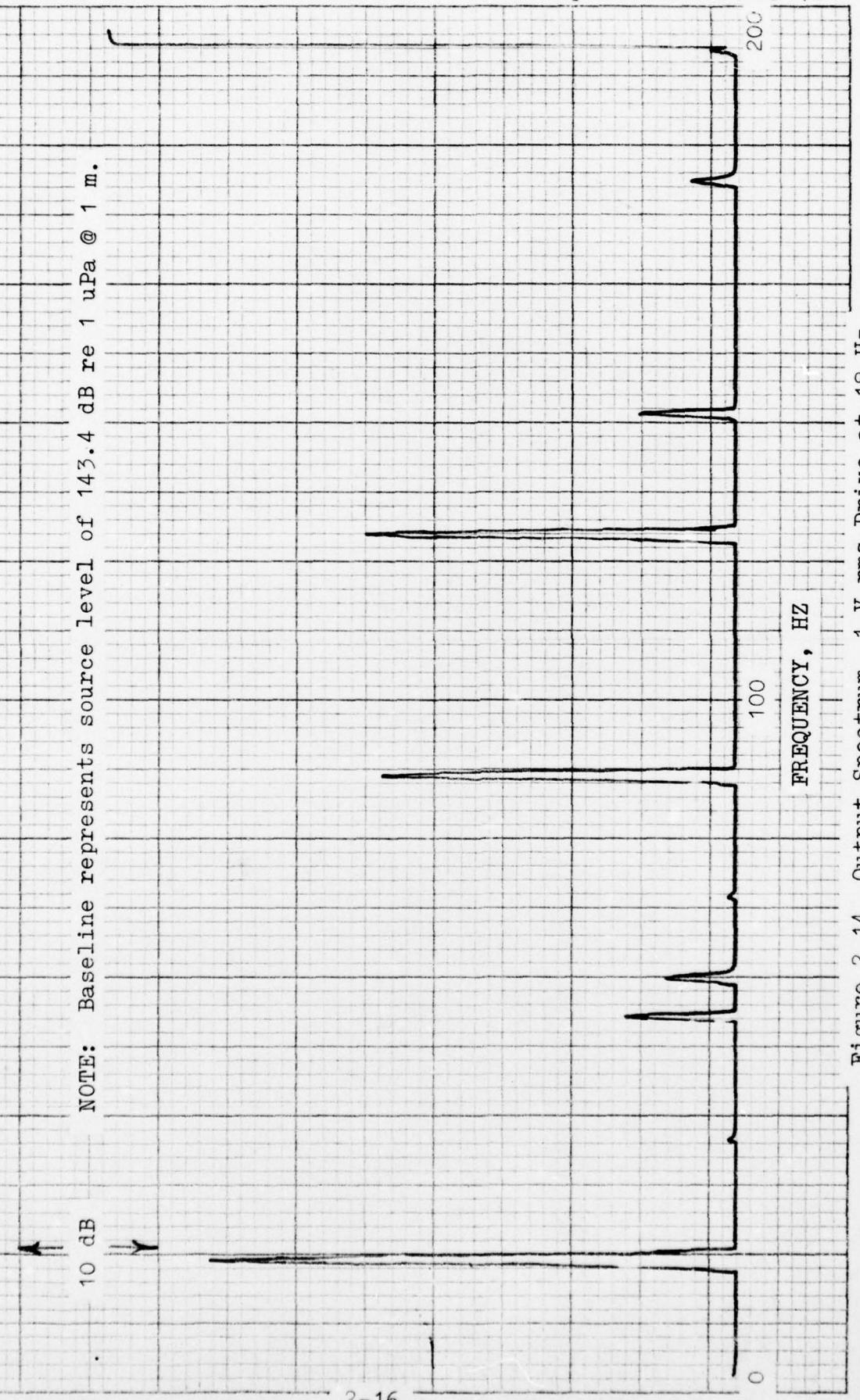


Figure 2.14 Output Spectrum, 1 V rms Drive at 18 Hz

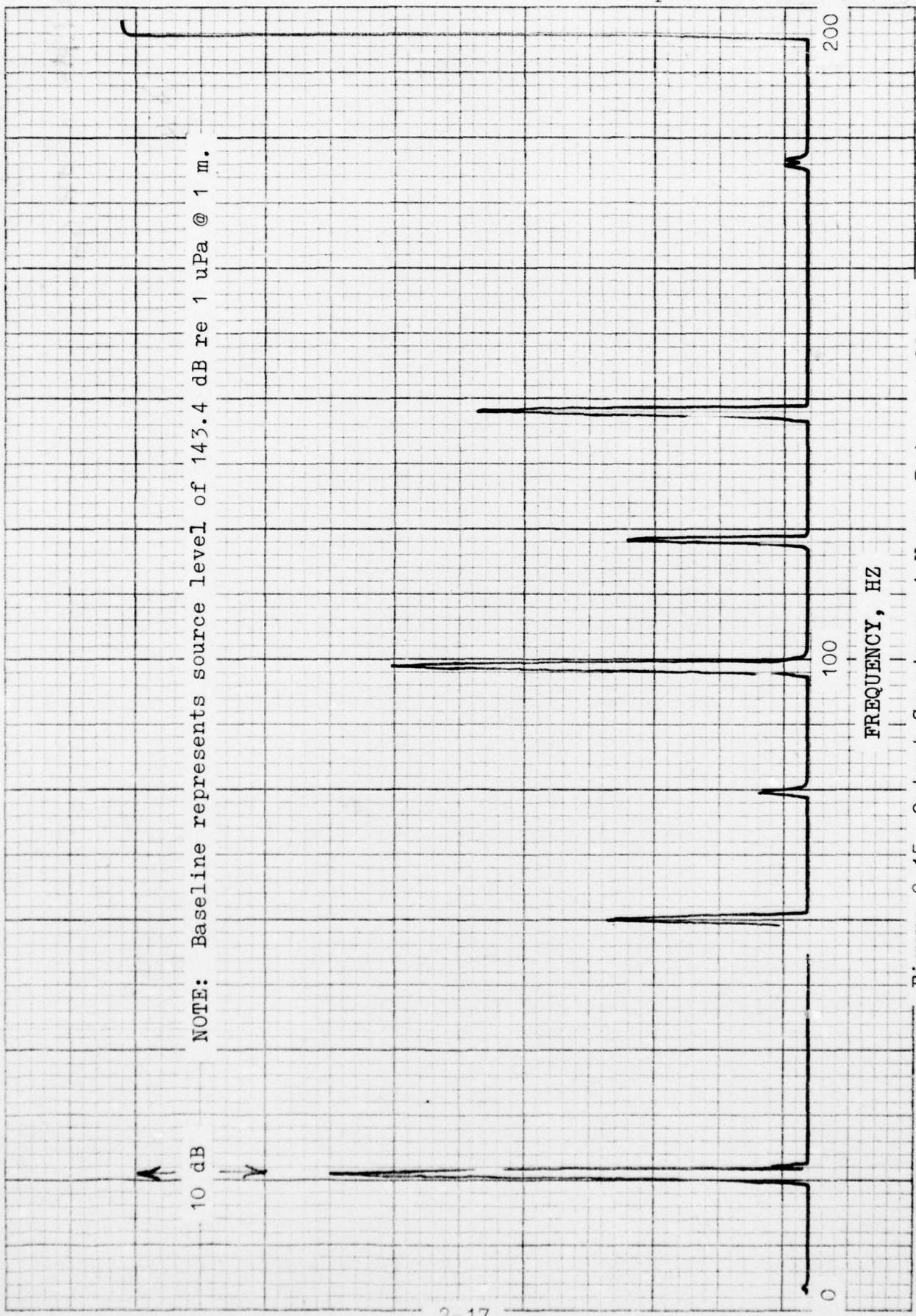


Figure 2.15 Output Spectrum, 1 V rms Drive at 20 Hz

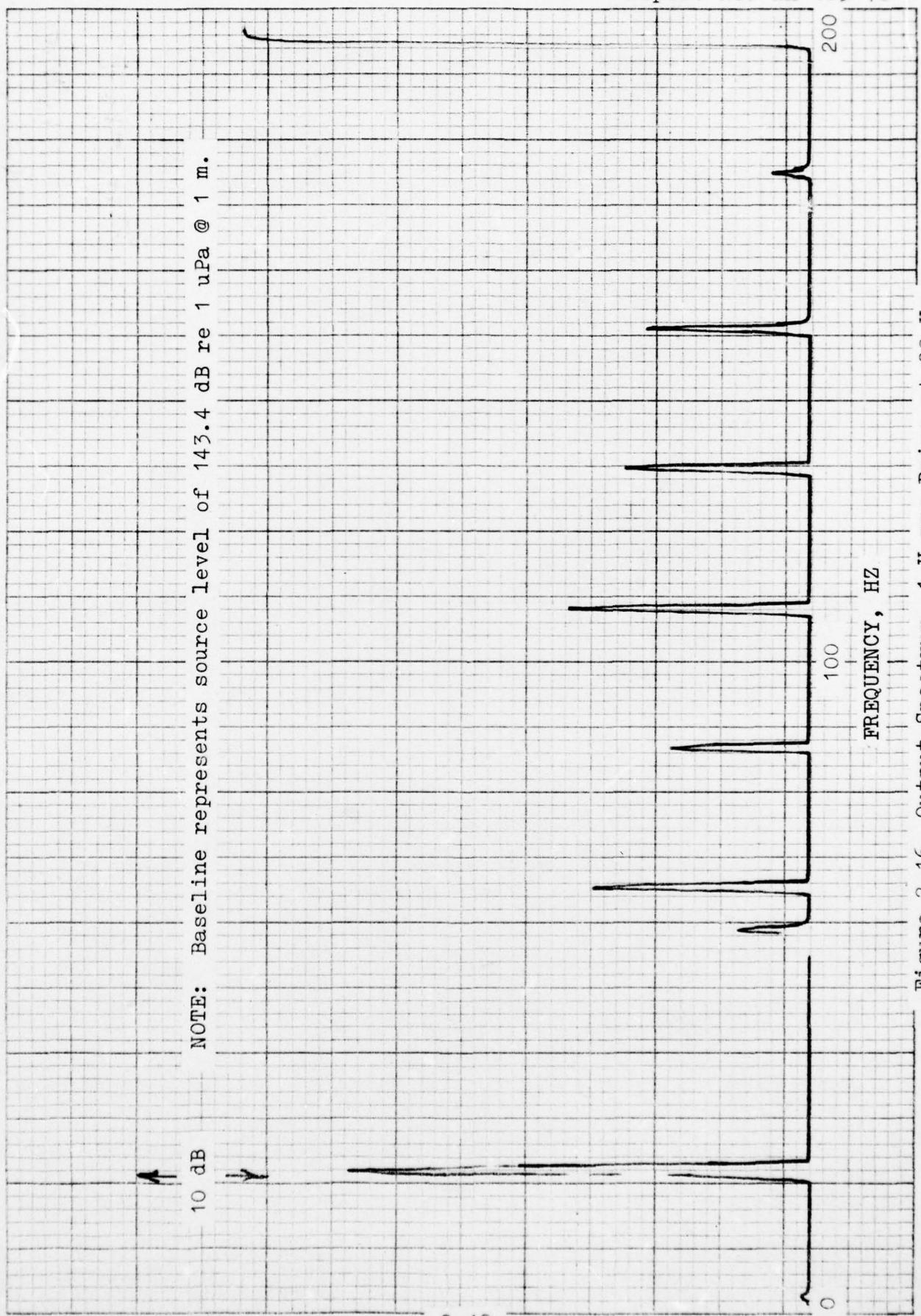


Figure 2.16 Output Spectrum, 1 V rms Drive at 22 Hz

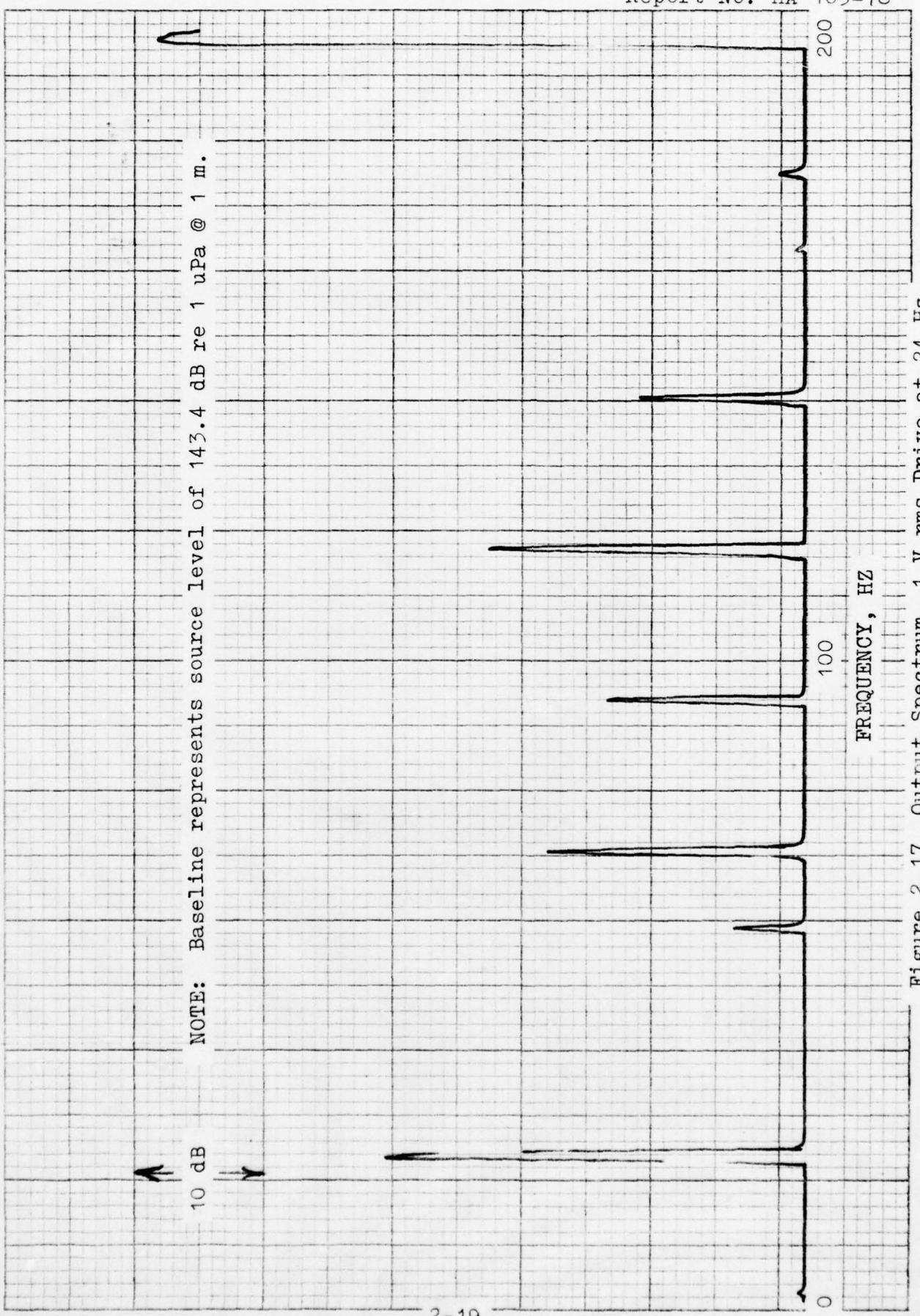


Figure 2.17 Output Spectrum, 1 V rms Drive at 24 Hz

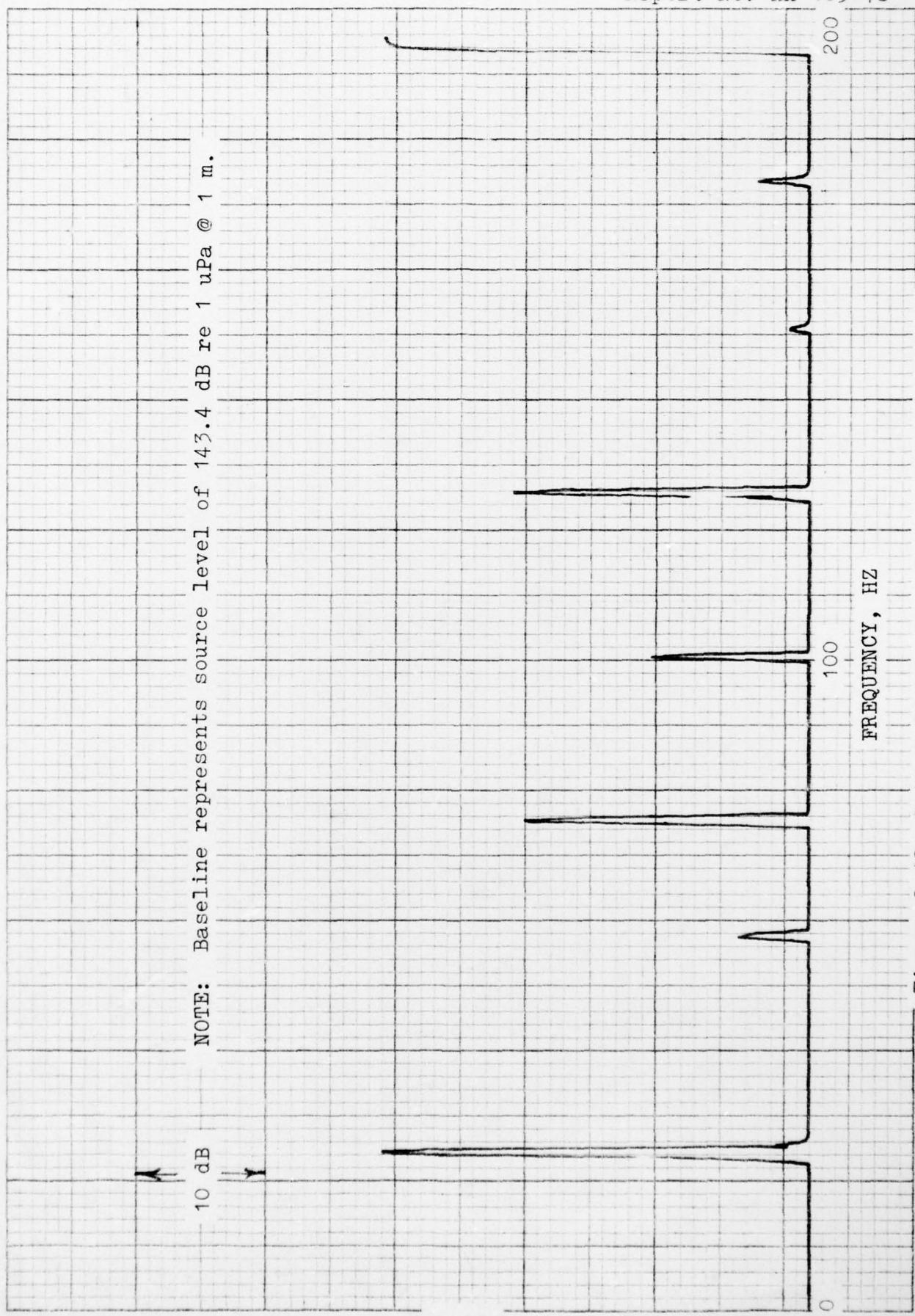


Figure 2.18 Output Spectrum, 1 V rms Drive at 26 Hz

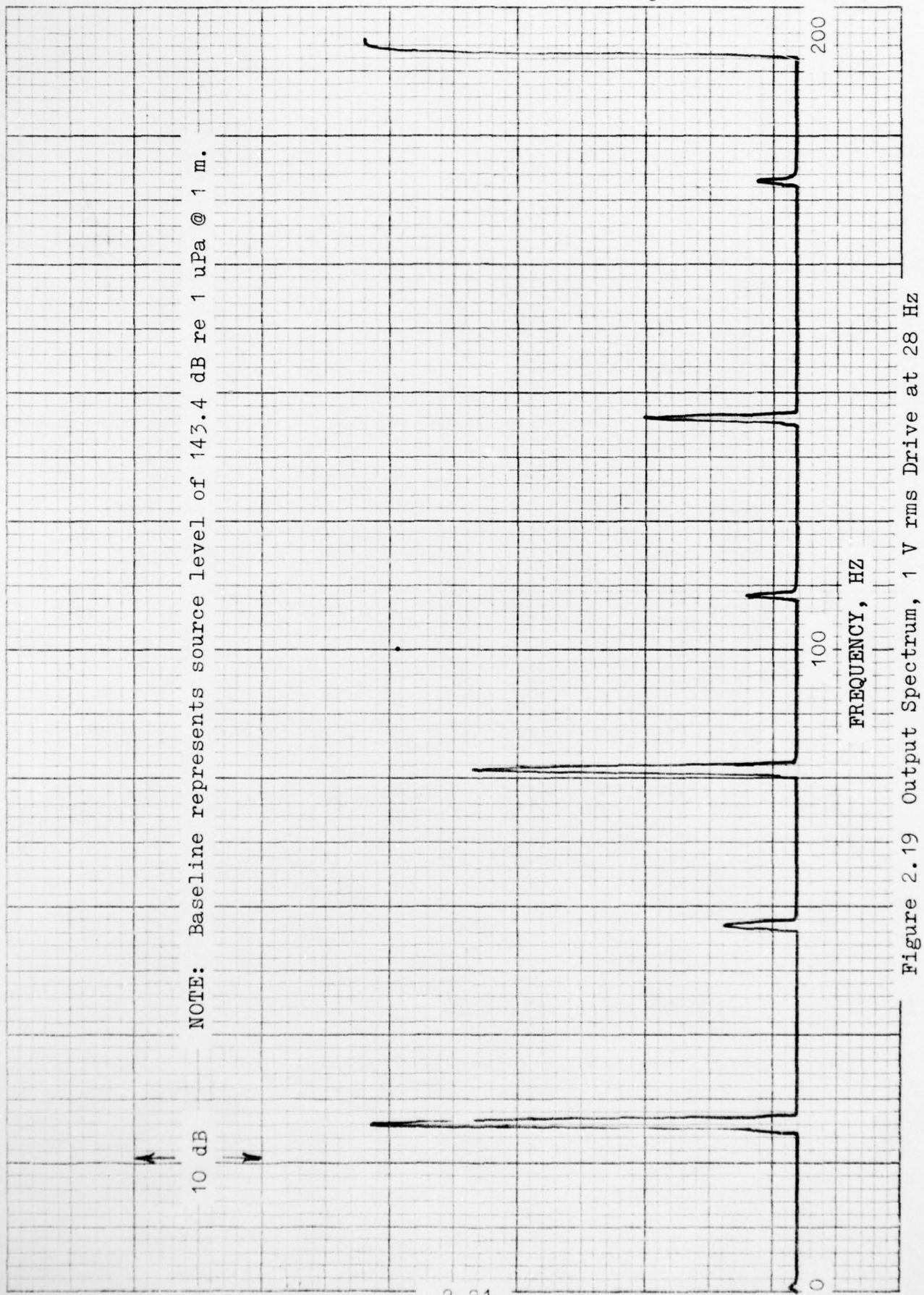


Figure 2.19 Output Spectrum, 1 V rms Drive at 28 Hz

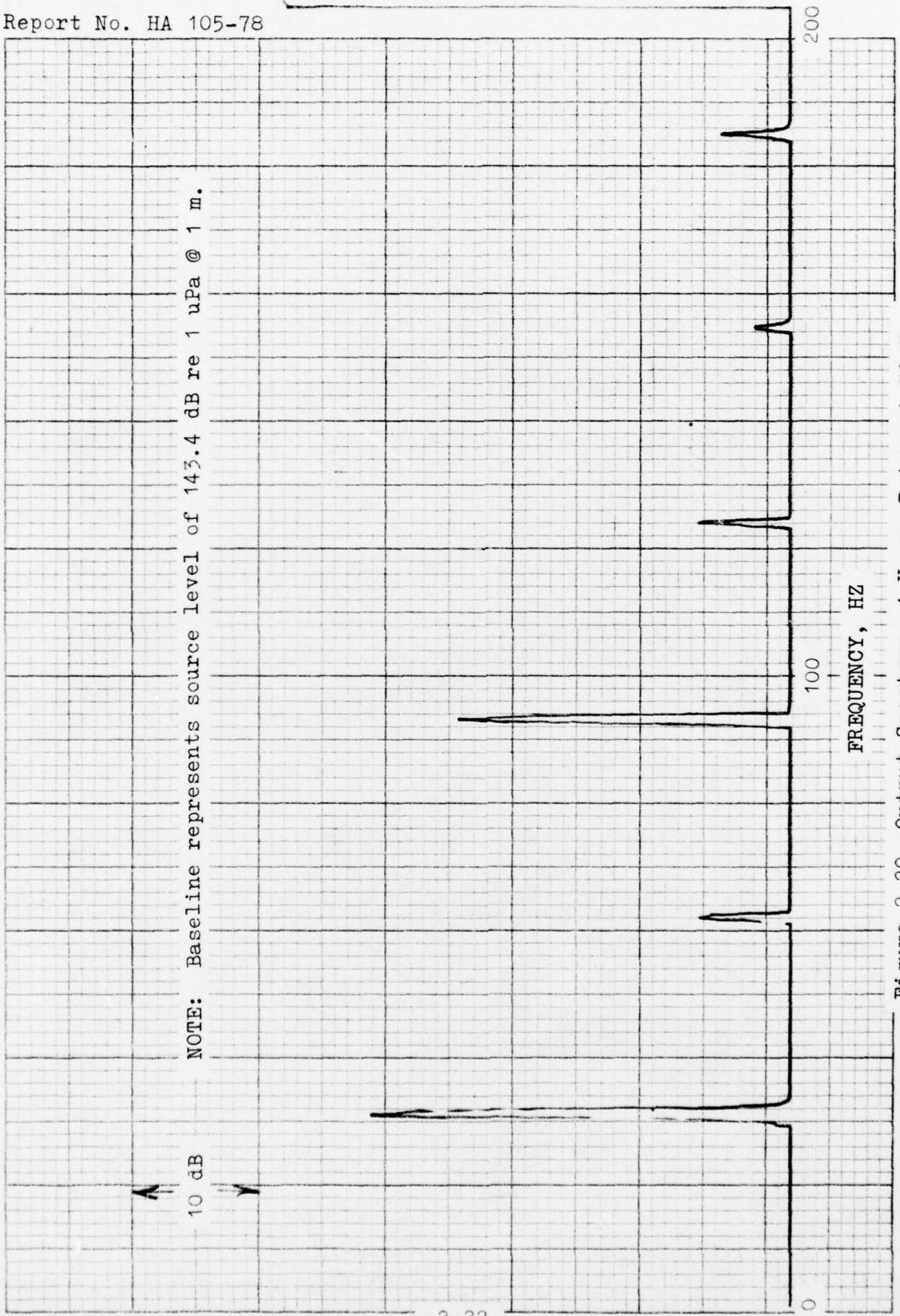


Figure 2.20 Output Spectrum, 1 V rms Drive at 30 Hz

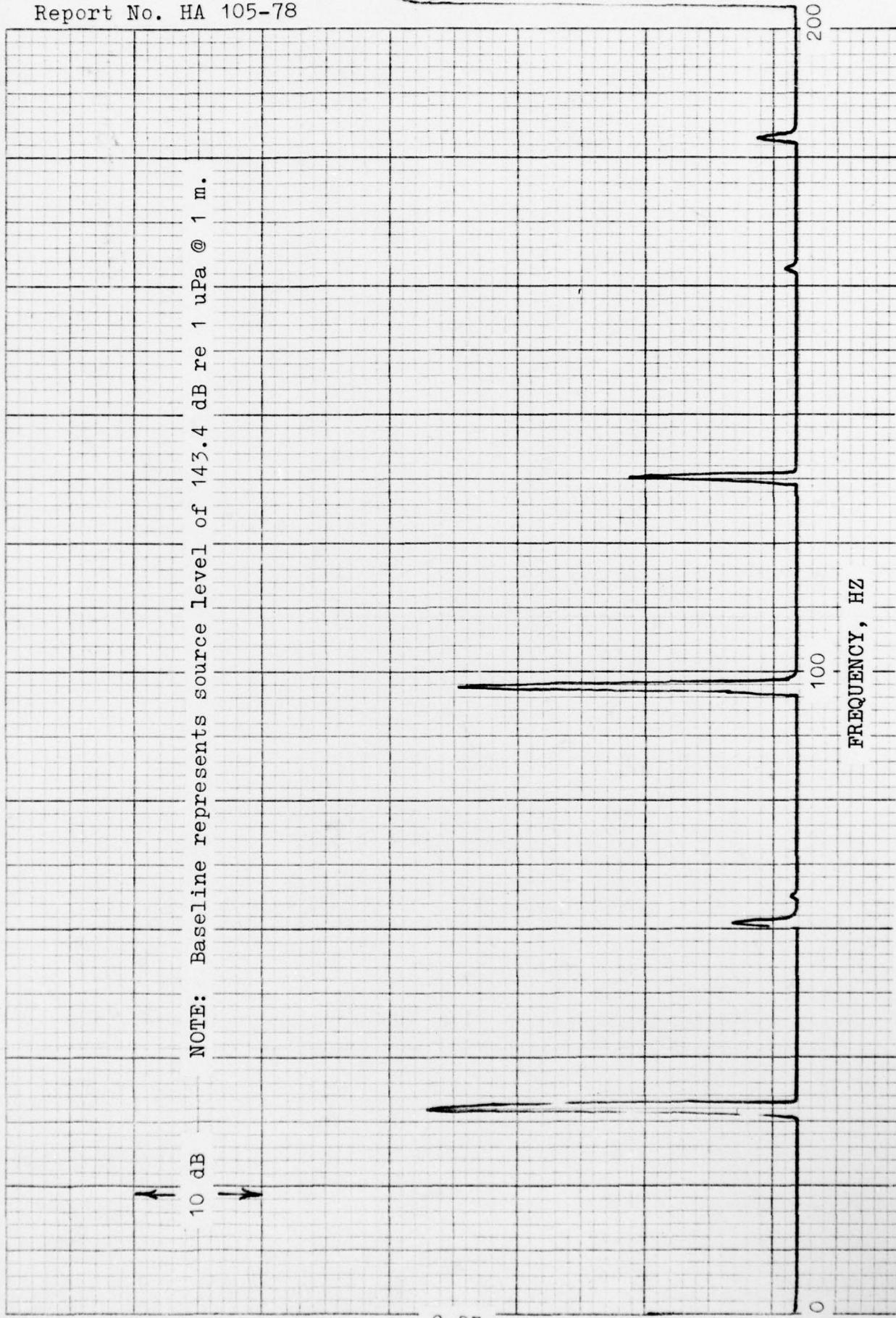


Figure 2.21 Output Spectrum, 1 V rms Drive at 32 Hz

APPENDIX A
ADDITIONAL HVLF-1
SENECA LAKE CALIBRATION DATA

DATE 1/31/78		TIME 10:00		MONITOR PANEL		SPECTRUM ANALYZER ETR (0.3 Hz BW)	
34	SHEET 1 OF 10			W	PUR SUP	FIRST	MAIN
35	BY B. Daugherty	(EST)		MTR	MTR PUMP	STAGE	STAGE
1	DRIVE (VRMS)	1.000		CUR	PUMP PRESSURE	ATTN	PRESSURE
2	DC BIAS	45.8		(Amp)	(PSI)	(dB)	(PSI)
3	PRECHARGE	46.9					
4	EXL TEMP	51.9°C		9.0	ACC		
5	MOTOR TEMP	49.2		9.5	9.0	0.5	6.2
6	WATER TEMP	23.8		10.0	90.8	+0.5	+4.2
7	ANALYZER CORRECTIONS			10.5	NCN		
8	OFFSET	20.4 dB		11.0			
9	SYS. GAIN	300 dB		11.5			
10	MON HYDROPHONE			12.0			
11	TYPE	F-37		12.5			
12	SENS	-203.1		13.0			
13	DIST	3.0 ft		13.5			
14	SPREAD LOSS	3.0 dB		14.0			
15	CORRECTED TERMINAL			14.5			
16	SENS	-177.0		15.0			
17	MON 28			15.5			
18	TYPE	H-36		16.0			
19	SENS	-171.8		16.5			
20	DIST	3.0 ft		17.0			
21	SPREAD LOSS	3.0 dB		17.5			
22	CAL HYDROPHONE			18.0			
23	TYPE	H-36		18.5			
24	SENS	-171.8		19.0			
25	DIST	3.0 ft		19.5			
26	SPREAD LOSS	3.0 dB		20.0			
27	CORRECTED TERMINAL			20.5			
28	SENS	-173.4		21.0			
29	ACCELEROMETER			21.5			
30	CORRECTION			22.0			
31	FACTOR			22.5			
32	TYPE ANALYZER			23.0			
33	SD 335			23.5			
34	FIN			24.0			
35				24.5			
36				25.0			
37				25.5			
38				161.5			
39				161.5			
40				161.5			

* front drive increased unstable

Frank W. Dink changes 5 to 0.6 Hz

0 dB = 3.16 Vrms

DATE 1/31/78		MONITOR PANEL		SPECTRUM ANALYZER		CAL					
SHEET 3 OF 10		TIME	FREQ	MAIN PUMP PRESSURE (PSI)	STAGE PRESSURE (PSI)	INPUT ATTEN. (dB)	STAGE ATTEN. (dB)	MAIN LEVEL (dBV)	MONITOR PHONICS (dBV)	ACCELEROMETER (dBV)	HYDROPHONE (dBV)
34	DC BIAS	45.8	7.0	8.0	8.5	7.0	7.5	-7.4	-11.0	-16.4	-27.1
35	FRECHARGE	40.3	7.5	10.0	9.5	0.0	6.5	-6.9	-9.9	-15.3	-25.9
36	OIL TEMP	47.7	171.5	10.0	29.5	0.0	6.8	-7.3	-9.9	-15.4	-25.9
37	HOTER TEMP	36.4	173.0	10.5	11.0	10.26	3.0	-23.3	-19.9	-8.9	-14.5
38	WATER TEMP	2.3	12.0	12.5	13.0	9.20	9.20	-7.2	-7.0	-14.4	-24.8
39	ANALYZER CORRECTIONS							-7.1	-6.9	-8.1	-13.6
40	OFFSET	2.0 dB						-7.1	-7.9	-13.5	-23.8
41	SAT. GAIN	2.0 dB						-7.1	-7.4	-13.4	-23.4
42	ANAL HYDROPHONE TYPE							-7.1	-7.0	-12.7	-22.4
43	SENS							-7.1	-6.3	-12.2	-20.8
44	VIST							-7.1	-6.2	-12.1	-20.9
45	SPREAD LOSS							-6.9	-5.8	-11.6	-20.9
46	CORRECTED TERMINAL SENS							-7.4	-6.3	-12.0	-21.8
47	140	10.5	14.5	16.6	14.4	20.71	11.18	10.95	-25.0	-13.9	-6.3
48	141	15.0	29.7	11.5	14.4						
49	142	15.5	15.5								
50	143	16.0									
51	144	16.5									
52	145	17.0									
53	146	17.5									
54	147	18.0									
55	148	18.5									
56	149	19.0									
57	150	19.5									
58	151	20.0	22.4	11.9	12.4	21.44	11.72	10.35	-28.5	-11.6	-8.6
59	152	20.5									
60	153	21.0									
61	154	21.5									
62	155	22.0									
63	156	22.5									
64	157	23.0									
65	158	23.5									
66	159	24.0									
67	160	24.5									
68	161	25.0									
69	162	25.5									
70	163	26.0									
71	164	26.5									
72	165	27.0									
73	166	27.5									
74	167	28.0									
75	168	28.5									
76	169	29.0									
77	170	29.5									
78	171	30.0									
79	172	30.5									
80	173	31.0									
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83	176	32.5									
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161	254	71.5									
162	255	72.0									
163	256	72.5									
164	257	73.0									
165	258	73.5									
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168	261	75.0									
169	262	75.5									
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178	271	80.0									
179	272	80.5									
180	273	81.0									
181	274	81.5									
182	275	82.0									
183	276	82.5									
184	277	83.0									
185	278	83.5									
186	279	84.0									
187	280	84.5									
188	281	85.0									
189	282	85.5									
190	283	86.0									
191	284	86.5									
192	285	87.0									

XVI. CHARTABLES

DATE 1/31/78		TIME		FIRST		MAIN		MON		ACCELER-		CAL	
TEST 5 OF 10		FREQ		NTR		PUR SUP		HYDRO-		OMETER HYDRO-		OMETER HYDRO-	
BY TB Daugherty		(EST)		(Hz)		(Hz)		(Hz)		(Hz)		(Hz)	
DRIVE (VRMS)	2.000	INPUT		FIRST		MAIN		DRIVE		MON		ACCELER-	
DC BIAS		ATTN		STAGE		STAGE		LEVEL		HYDRO-		OMETER	
PRECHARGE		SETTING		ATTN		ATTN		PHASE		PHONE		HYDRO-	
OIL TEMP		(dB)		(dB)		(dB)		(dB)		(dB)		(dB)	
MOTOR TEMP		(VRMS)		(VRMS)		(VRMS)		(VRMS)		(VRMS)		(VRMS)	
WATER TEMP		(VRMS)		(VRMS)		(VRMS)		(VRMS)		(VRMS)		(VRMS)	
ANALYZER CORRECTIONS					<th></th> <td><th></th><td><th></th><td><th></th><td></td></td></td></td>		<th></th> <td><th></th><td><th></th><td></td></td></td>		<th></th> <td><th></th><td></td></td>		<th></th> <td></td>		
OFFSET			<th></th> <td><th></th><th></th><th></th><th></th><th></th><th></th><th></th><td></td></td>		<th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <td></td>								
SYS. GAIN			<th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <td></td>										
MON HYDROPHONE													
TYPE		SENS	<th>TYPE</th> <td></td> <th>SENS</th> <td><th>TYPE</th><td></td><th>SENS</th><td></td><th>TYPE</th><td></td></td>	TYPE		SENS	<th>TYPE</th> <td></td> <th>SENS</th> <td></td> <th>TYPE</th> <td></td>	TYPE		SENS		TYPE	
SENS		TYPE		SENS		TYPE		SENS		TYPE		SENS	
DIST		TYPE		DIST		TYPE		DIST		TYPE		DIST	
SPREAD LOSS		TYPE		SPREAD LOSS		TYPE		SPREAD LOSS		TYPE		SPREAD LOSS	
CORRECTED TERMINAL		SENS		CORRECTED TERMINAL		SENS		CORRECTED TERMINAL		SENS		CORRECTED TERMINAL	
SENS		SENS		SENS		SENS		SENS		SENS		SENS	
CAL HYDROPHONE			<th>CAL HYDROPHONE</th> <td></td> <th></th> <td><th>CAL HYDROPHONE</th><td></td><th></th><td><th>CAL HYDROPHONE</th><td></td></td></td>	CAL HYDROPHONE			<th>CAL HYDROPHONE</th> <td></td> <th></th> <td><th>CAL HYDROPHONE</th><td></td></td>	CAL HYDROPHONE			<th>CAL HYDROPHONE</th> <td></td>	CAL HYDROPHONE	
TYPE		TYPE	<th>TYPE</th> <td><th>TYPE</th><td><th>TYPE</th><td><th>TYPE</th><td><th>TYPE</th><td></td></td></td></td></td>	TYPE	<th>TYPE</th> <td><th>TYPE</th><td><th>TYPE</th><td><th>TYPE</th><td></td></td></td></td>	TYPE	<th>TYPE</th> <td><th>TYPE</th><td><th>TYPE</th><td></td></td></td>	TYPE	<th>TYPE</th> <td><th>TYPE</th><td></td></td>	TYPE	<th>TYPE</th> <td></td>	TYPE	
SENS		SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td></td></td>	SENS	<th>SENS</th> <td></td>	SENS	
DIST		DIST	<th>DIST</th> <td><th>DIST</th><td><th>DIST</th><td><th>DIST</th><td><th>DIST</th><td></td></td></td></td></td>	DIST	<th>DIST</th> <td><th>DIST</th><td><th>DIST</th><td><th>DIST</th><td></td></td></td></td>	DIST	<th>DIST</th> <td><th>DIST</th><td><th>DIST</th><td></td></td></td>	DIST	<th>DIST</th> <td><th>DIST</th><td></td></td>	DIST	<th>DIST</th> <td></td>	DIST	
SPREAD LOSS		SPREAD LOSS	<th>SPREAD LOSS</th> <td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td></td></td></td></td></td>	SPREAD LOSS	<th>SPREAD LOSS</th> <td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td></td></td></td></td>	SPREAD LOSS	<th>SPREAD LOSS</th> <td><th>SPREAD LOSS</th><td><th>SPREAD LOSS</th><td></td></td></td>	SPREAD LOSS	<th>SPREAD LOSS</th> <td><th>SPREAD LOSS</th><td></td></td>	SPREAD LOSS	<th>SPREAD LOSS</th> <td></td>	SPREAD LOSS	
CORRECTED TERMINAL		CORRECTED TERMINAL	<th>CORRECTED TERMINAL</th> <td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td></td></td></td></td></td>	CORRECTED TERMINAL	<th>CORRECTED TERMINAL</th> <td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td></td></td></td></td>	CORRECTED TERMINAL	<th>CORRECTED TERMINAL</th> <td><th>CORRECTED TERMINAL</th><td><th>CORRECTED TERMINAL</th><td></td></td></td>	CORRECTED TERMINAL	<th>CORRECTED TERMINAL</th> <td><th>CORRECTED TERMINAL</th><td></td></td>	CORRECTED TERMINAL	<th>CORRECTED TERMINAL</th> <td></td>	CORRECTED TERMINAL	
SENS		SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td></td></td>	SENS	<th>SENS</th> <td></td>	SENS	
ACCELEROMETER			<th>ACCELEROMETER</th> <td></td> <th></th> <td><th>ACCELEROMETER</th><td></td><th></th><td><th>ACCELEROMETER</th><td></td></td></td>	ACCELEROMETER			<th>ACCELEROMETER</th> <td></td> <th></th> <td><th>ACCELEROMETER</th><td></td></td>	ACCELEROMETER			<th>ACCELEROMETER</th> <td></td>	ACCELEROMETER	
CORRECTION		CORRECTION	<th>CORRECTION</th> <td><th>CORRECTION</th><td><th>CORRECTION</th><td><th>CORRECTION</th><td><th>CORRECTION</th><td></td></td></td></td></td>	CORRECTION	<th>CORRECTION</th> <td><th>CORRECTION</th><td><th>CORRECTION</th><td><th>CORRECTION</th><td></td></td></td></td>	CORRECTION	<th>CORRECTION</th> <td><th>CORRECTION</th><td><th>CORRECTION</th><td></td></td></td>	CORRECTION	<th>CORRECTION</th> <td><th>CORRECTION</th><td></td></td>	CORRECTION	<th>CORRECTION</th> <td></td>	CORRECTION	
FACTOR		FACTOR	<th>FACTOR</th> <td><th>FACTOR</th><td><th>FACTOR</th><td><th>FACTOR</th><td><th>FACTOR</th><td></td></td></td></td></td>	FACTOR	<th>FACTOR</th> <td><th>FACTOR</th><td><th>FACTOR</th><td><th>FACTOR</th><td></td></td></td></td>	FACTOR	<th>FACTOR</th> <td><th>FACTOR</th><td><th>FACTOR</th><td></td></td></td>	FACTOR	<th>FACTOR</th> <td><th>FACTOR</th><td></td></td>	FACTOR	<th>FACTOR</th> <td></td>	FACTOR	
TYPE ANALYZER			<th>TYPE ANALYZER</th> <td></td> <th></th> <td><th>TYPE ANALYZER</th><td></td><th></th><td><th>TYPE ANALYZER</th><td></td></td></td>	TYPE ANALYZER			<th>TYPE ANALYZER</th> <td></td> <th></th> <td><th>TYPE ANALYZER</th><td></td></td>	TYPE ANALYZER			<th>TYPE ANALYZER</th> <td></td>	TYPE ANALYZER	
SENS		SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td><th>SENS</th><td></td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td><th>SENS</th><td></td></td></td>	SENS	<th>SENS</th> <td><th>SENS</th><td></td></td>	SENS	<th>SENS</th> <td></td>	SENS	
40		39	<th>38</th> <td><th>37</th><td><th>36</th><td><th>35</th><td><th>34</th><td></td></td></td></td></td>	38	<th>37</th> <td><th>36</th><td><th>35</th><td><th>34</th><td></td></td></td></td>	37	<th>36</th> <td><th>35</th><td><th>34</th><td></td></td></td>	36	<th>35</th> <td><th>34</th><td></td></td>	35	<th>34</th> <td></td>	34	
DATE 1/31/78		TIME		FIRST		MAIN		MON		ACCELER-		CAL	
TEST 5 OF 10		FREQ		STAGE		STAGE		HYDRO-		OMETER		HYDRO-	
BY TB Daugherty		(EST)		PRESSURE		PRESSURE		PHONE		HYDRO-		PHONE	
DRIVE (VRMS)	2.000	INPUT		ATTN		ATTN		(dB)		(dB)		(dB)	
DC BIAS													
PRECHARGE													
OIL TEMP													
MOTOR TEMP													
WATER TEMP													
ANALYZER CORRECTIONS													
OFFSET													
SYS. GAIN													
MON HYDROPHONE													
TYPE													
SENS													
DIST													
SPREAD LOSS													
CORRECTED TERMINAL													
SENS													
CAL HYDROPHONE													
TYPE													
SENS													
DIST													
SPREAD LOSS													
CORRECTED TERMINAL													
SENS													
ACCELEROMETER													
CORRECTION													
FACTOR													
TYPE ANALYZER													
SENS													
40													

MONITOR PANEL	SPECTRUM ANALYZER GTR (0.3 Hz BW)									
	DATE	TIME	PRE	MAIN	FIRST	STAGE	MAIN	DRIVE	MAIN	ACCELER.
CHG	(EST)	MP	MP	STAGE	PRESSURE	STAGE	LEVEL	HYDRO-	CAL	
34	1/31/78	6.0	7.0	8.0	11.0	13.0	14.0	15.2	-23.1	-34.3
35		7.0	8.0	9.0	12.0	13.0	14.2	15.2	-23.4	-34.2
36		8.0	9.0	10.0	13.0	14.0	15.3	16.2	-23.7	-34.7
37		9.0	10.0	11.0	14.0	15.0	16.2	17.2	-24.0	-35.2
38		10.0	11.0	12.0	15.0	16.0	17.2	18.2	-24.3	-35.3
39		11.0	12.0	13.0	16.0	17.0	18.2	19.2	-24.6	-35.6
40		12.0	13.0	14.0	17.0	18.0	19.2	20.2	-24.9	-35.9
41		13.0	14.0	15.0	18.0	19.0	20.2	21.2	-25.2	-36.2
42		14.0	15.0	16.0	19.0	20.0	21.0	22.0	-25.5	-36.5
43		15.0	16.0	17.0	20.0	21.0	22.0	23.0	-25.8	-36.8
44		16.0	17.0	18.0	21.0	22.0	23.0	24.0	-26.1	-37.1
45		17.0	18.0	19.0	22.0	23.0	24.0	25.0	-26.4	-37.4
46		18.0	19.0	20.0	23.0	24.0	25.0	26.0	-26.7	-37.7
47		19.0	20.0	21.0	24.0	25.0	26.0	27.0	-27.0	-38.0
48		20.0	21.0	22.0	25.0	26.0	27.0	28.0	-27.3	-38.3
49		21.0	22.0	23.0	26.0	27.0	28.0	29.0	-27.6	-38.6
50		22.0	23.0	24.0	27.0	28.0	29.0	30.0	-27.9	-38.9
51		23.0	24.0	25.0	28.0	29.0	30.0	31.0	-28.2	-39.2
52		24.0	25.0	26.0	29.0	30.0	31.0	32.0	-28.5	-39.5
53		25.0	26.0	27.0	30.0	31.0	32.0	33.0	-28.8	-39.8
54		26.0	27.0	28.0	31.0	32.0	33.0	34.0	-29.1	-40.1
55		27.0	28.0	29.0	32.0	33.0	34.0	35.0	-29.4	-40.4
56		28.0	29.0	30.0	33.0	34.0	35.0	36.0	-29.7	-40.7
57		29.0	30.0	31.0	34.0	35.0	36.0	37.0	-30.0	-40.0
58		30.0	31.0	32.0	35.0	36.0	37.0	38.0	-30.3	-40.3
59		31.0	32.0	33.0	36.0	37.0	38.0	39.0	-30.6	-40.6
60		32.0	33.0	34.0	37.0	38.0	39.0	40.0	-30.9	-40.9
61		33.0	34.0	35.0	38.0	39.0	40.0	41.0	-31.2	-41.2
62		34.0	35.0	36.0	39.0	40.0	41.0	42.0	-31.5	-41.5
63		35.0	36.0	37.0	40.0	41.0	42.0	43.0	-31.8	-41.8
64		36.0	37.0	38.0	41.0	42.0	43.0	44.0	-32.1	-42.1
65		37.0	38.0	39.0	42.0	43.0	44.0	45.0	-32.4	-42.4
66		38.0	39.0	40.0	43.0	44.0	45.0	46.0	-32.7	-42.7
67		39.0	40.0	41.0	44.0	45.0	46.0	47.0	-33.0	-43.0
68		40.0	41.0	42.0	45.0	46.0	47.0	48.0	-33.3	-43.3
69		41.0	42.0	43.0	46.0	47.0	48.0	49.0	-33.6	-43.6
70		42.0	43.0	44.0	47.0	48.0	49.0	50.0	-33.9	-43.9
71		43.0	44.0	45.0	48.0	49.0	50.0	51.0	-34.2	-44.2
72		44.0	45.0	46.0	49.0	50.0	51.0	52.0	-34.5	-44.5
73		45.0	46.0	47.0	50.0	51.0	52.0	53.0	-34.8	-44.8
74		46.0	47.0	48.0	51.0	52.0	53.0	54.0	-35.1	-45.1
75		47.0	48.0	49.0	52.0	53.0	54.0	55.0	-35.4	-45.4
76		48.0	49.0	50.0	53.0	54.0	55.0	56.0	-35.7	-45.7
77		49.0	50.0	51.0	54.0	55.0	56.0	57.0	-36.0	-46.0
78		50.0	51.0	52.0	55.0	56.0	57.0	58.0	-36.3	-46.3
79		51.0	52.0	53.0	56.0	57.0	58.0	59.0	-36.6	-46.6
80		52.0	53.0	54.0	57.0	58.0	59.0	60.0	-36.9	-46.9
81		53.0	54.0	55.0	58.0	59.0	60.0	61.0	-37.2	-47.2
82		54.0	55.0	56.0	59.0	60.0	61.0	62.0	-37.5	-47.5
83		55.0	56.0	57.0	60.0	61.0	62.0	63.0	-37.8	-47.8
84		56.0	57.0	58.0	61.0	62.0	63.0	64.0	-38.1	-48.1
85		57.0	58.0	59.0	62.0	63.0	64.0	65.0	-38.4	-48.4
86		58.0	59.0	60.0	63.0	64.0	65.0	66.0	-38.7	-48.7
87		59.0	60.0	61.0	64.0	65.0	66.0	67.0	-39.0	-49.0
88		60.0	61.0	62.0	65.0	66.0	67.0	68.0	-39.3	-49.3
89		61.0	62.0	63.0	66.0	67.0	68.0	69.0	-39.6	-49.6
90		62.0	63.0	64.0	67.0	68.0	69.0	70.0	-39.9	-49.9
91		63.0	64.0	65.0	68.0	69.0	70.0	71.0	-40.2	-50.2
92		64.0	65.0	66.0	69.0	70.0	71.0	72.0	-40.5	-50.5
93		65.0	66.0	67.0	70.0	71.0	72.0	73.0	-40.8	-50.8
94		66.0	67.0	68.0	71.0	72.0	73.0	74.0	-41.1	-51.1
95		67.0	68.0	69.0	72.0	73.0	74.0	75.0	-41.4	-51.4
96		68.0	69.0	70.0	73.0	74.0	75.0	76.0	-41.7	-51.7
97		69.0	70.0	71.0	74.0	75.0	76.0	77.0	-42.0	-52.0
98		70.0	71.0	72.0	75.0	76.0	77.0	78.0	-42.3	-52.3
99		71.0	72.0	73.0	76.0	77.0	78.0	79.0	-42.6	-52.6
100		72.0	73.0	74.0	77.0	78.0	79.0	80.0	-42.9	-52.9
101		73.0	74.0	75.0	78.0	79.0	80.0	81.0	-43.2	-53.2
102		74.0	75.0	76.0	79.0	80.0	81.0	82.0	-43.5	-53.5
103		75.0	76.0	77.0	80.0	81.0	82.0	83.0	-43.8	-53.8
104		76.0	77.0	78.0	81.0	82.0	83.0	84.0	-44.1	-54.1
105		77.0	78.0	79.0	82.0	83.0	84.0	85.0	-44.4	-54.4
106		78.0	79.0	80.0	83.0	84.0	85.0	86.0	-44.7	-54.7
107		79.0	80.0	81.0	84.0	85.0	86.0	87.0	-45.0	-55.0
108		80.0	81.0	82.0	85.0	86.0	87.0	88.0	-45.3	-55.3
109		81.0	82.0	83.0	86.0	87.0	88.0	89.0	-45.6	-55.6
110		82.0	83.0	84.0	87.0	88.0	89.0	90.0	-45.9	-55.9
111		83.0	84.0	85.0	88.0	89.0	90.0	91.0	-46.2	-56.2
112		84.0	85.0	86.0	89.0	90.0	91.0	92.0	-46.5	-56.5
113		85.0	86.0	87.0	90.0	91.0	92.0	93.0	-46.8	-56.8
114		86.0	87.0	88.0	91.0	92.0	93.0	94.0	-47.1	-57.1
115		87.0	88.0	89.0	92.0	93.0	94.0	95.0	-47.4	-57.4
116		88.0	89.0	90.0	93.0	94.0	95.0	96.0	-47.7	-57.7
117		89.0	90.0	91.0	94.0	95.0	96.0	97.0	-48.0	-58.0
118		90.0	91.0	92.0	95.0	96.0	97.0	98.0	-48.3	-58.3
119		91.0	92.0	93.0	96.0	97.0	98.0	99.0	-48.6	-58.6
120		92.0	93.0	94.0	97.0	98.0	99.0	100.0	-48.9	-58.9
121		93.0	94.0	95.0	98.0	99.0	100.0	101.0	-49.2	-59.2
122		94.0	95.0	96.0	99.0	100.0	101.0	102.0	-49.5	-59.5
123		95.0	96.0	97.0	100.0	101.0	102.0	103.0	-49.8	-59.8
124		96.0	97.0	98.0	101.0	102.0	103.0	104.0	-50.1	-60.1
125		97.0	98.0	99.0	102.0	103.0	104.0	105.0	-50.4	-60.4
126		98.0	99.0	100.0	103.0	104.0	105.0	106.0	-50.7	-60.7
127		99.0	100.0	101.0	104.0	105.0	106.0	107.0	-51.0	-61.0
128		100.0	101.0	102.0	105.0	106.0	107.0	108.0	-51.3	-61.3
129		101.0	102.0	103.0	106.0	107.0	108.0	109.0	-51.6	-61.6
130		102.0	103.0	104.0	107.0	108.0	109.0	110.0	-51.9	-61.9
131		103.0	104.0	105.0	108.0	109.0	110.0	111.0	-52.2	-62.2
132		104.0	105.0	106.0	109.0	110.0	111.0	112.0	-52.5	-62.5
133		105.0	106.0	107.0	110.0	111.0	112.0	113.0	-52.8	-62.8
134		106.0	107.0	108.0	111.0	112.0	113.0	114.0	-53.1	-63.1
135		107.0	108.0	109.0	112.0	113.0	114.0	115.0	-53.4	-63.4
136		108.0	109.0	110.0	113.0	114.0	115.0	116.0	-53.7	-63.7
137		109.0	110.0	111.0	114.0	115.0	116.0	117.0	-54.0	-64.0
138		110.0	111.0	112.0	115.0	116.0	117.0	118.0	-54.3	-64.3
139		111.0	112.0	113.0	116.0	117.0	118.0	119.0	-54.6	-64.6
140		112.0	113.0	114.0	117.0	118.0	119.0	120.0	-54.9	-64.9
141		113.0	114.0	115.0	118.0	119.0	120.0	121.0	-55.2	-65.2
142		114.0	115.0	116.0	119.0	120.0	121.0	122.0	-55.5	-65.5
143		115.0	116.0</							

3.16 V₀₂ ml

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MONITOR PANEL										SPECTRUM ANALYZER (0.3 Hz BW)									
DATE 1-31-78	TIME 12:17:18	TEST	ATR	IN	PUR	PUR	FIRST	MAIN	DRIVE	MON	ACCELER-	CAL							
SHEET 8 OF 10	OF 10	TEST	ATR	SUP	SUP	STAGE	STAGE	STAGE	LEVEL	HYDRO-	OMETER	HYDRO-							
BY D. A. KIDD																			
DRIVE (VRMS) 0.105																			
DC BIAS	6.0	6.0																	
PRECHARGE	10.0	10.0																	
OL TEMP	12.0	12.0																	
MOTOR TEMP	13.0	13.0																	
WATER TEMP	14.0	14.0																	
ANALYZER CORRECTIONS																			
OFFSET	15.0	15.0																	
SP45. GAIN	16.0	16.0																	
ANALYZER CORRECTIONS	17.0	17.0																	
OFFSET	18.0	18.0																	
SP45. GAIN	19.0	19.0																	
MAIN HYDROPHONE	20.0	20.0																	
TYPE	21.0	21.0																	
SENS	22.0	22.0																	
DIST	23.0	23.0																	
SPREAD LOSS	24.0	24.0																	
CORRECTED TERMINAL	25.0	25.0																	
SENS	26.0	26.0																	
CAL HYDROPHONE	27.0	27.0																	
TYPE	28.0	28.0																	
SENS	29.0	29.0																	
DIST	30.0	30.0																	
SPREAD LOSS	31.0	31.0																	
CORRECTED TERMINAL	32.0	32.0																	
SENS	33.0	33.0																	
CAL HYDROPHONE	34.0	34.0																	
TYPE	35.0	35.0																	
SENS	36.0	36.0																	
CAL HYDROPHONE	37.0	37.0																	
TYPE	38.0	38.0																	
SENS	39.0	39.0																	
CAL HYDROPHONE	40.0	40.0																	

* meter not accurate in this range

ER (03.12.84)

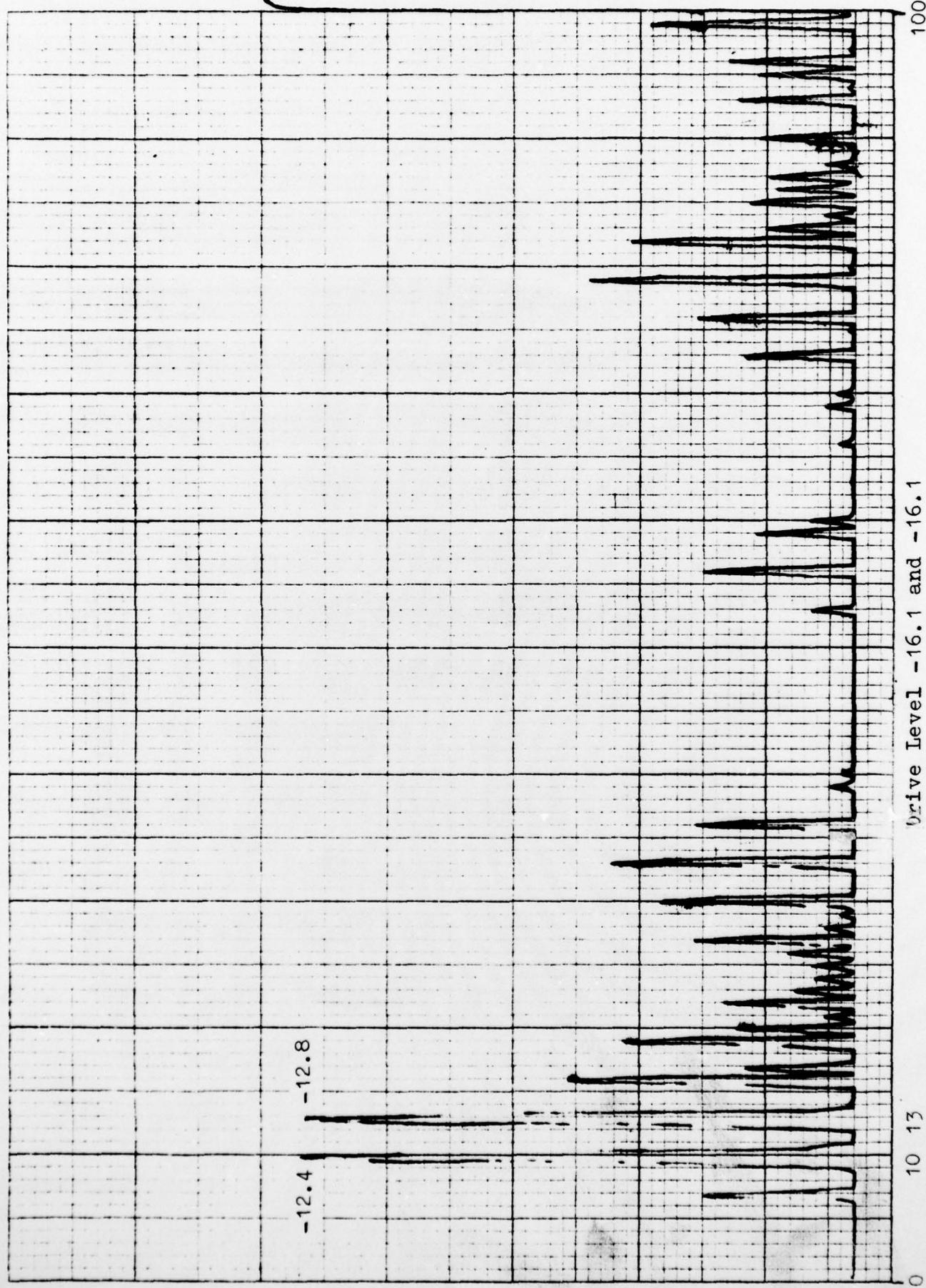
MONITOR PANEL	SPECTRUM ANALYZER (0.3 Hz BW)									
	TIME	TIME	WAVE	PURGE	FIRST	MAIN	INPUT	FIRST	MAIN	ACCELER.
9 OF 12	0900	0900	0900	0900	0900	0900	ATTN	STAGE	LEVEL	CAL
34 2. 1. K120	(EST)	(EST)	(EST)	(EST)	(EST)	(EST)	(dBV)	(dBV)	(dBV)	(dBV)
DRIVE (VRMS)	0.37	6.0	7.0	6.0	20					-38.0
DC BIAS		7.0	7.0	7.0						-36.6
PRECHARGE		10.0	11.0	12.0						-36.4
OIL TEMP		13.0	14.0	15.0						-35.5
NOZ TEMP		16.0	17.0	18.0						-35.0
WATER TEMP		19.0	20.0	21.0						-35.0
ANALYZER CORRECTIONS		22.0	23.0	24.0						-34.0
OFFSET		25.0	26.0	27.0						-34.2
SYS. GAIN		28.0	29.0	30.0						-33.9
MON HYDROPHONE		31.0	32.0	33.0						-33.9
TYPE		34.0	35.0	36.0						-34.2
SENS		37.0	38.0	39.0						-34.2
DIST		40.0	41.0	42.0						-34.2
SPREAD LOSS		43.0	44.0	45.0						-34.2
CORRECTED TERMINAL		46.0	47.0	48.0						-34.2
SENS		49.0	50.0	51.0						-34.2
CAL HYDROPHONE		52.0	53.0	54.0						-34.2
TYPE		55.0	56.0	57.0						-34.2
SENS		58.0	59.0	60.0						-34.2
DIST		61.0	62.0	63.0						-34.2
SPREAD LOSS		64.0	65.0	66.0						-34.2
CORRECTED TERMINAL		67.0	68.0	69.0						-34.2
SENS		70.0	71.0	72.0						-34.2
CAL HYDROPHONE		73.0	74.0	75.0						-34.2
TYPE		76.0	77.0	78.0						-34.2
SENS		79.0	80.0	81.0						-34.2
DIST		82.0	83.0	84.0						-34.2
SPREAD LOSS		85.0	86.0	87.0						-34.2
CORRECTED TERMINAL		88.0	89.0	90.0						-34.2
SENS		91.0	92.0	93.0						-34.2
ACCELEROMETER		94.0	95.0	96.0						-41.2
CORRECTION		97.0	98.0	99.0						-45.4
FACTOR		100.0	101.0	102.0						-47.4
TYPE ANALYZER		103.0	104.0	105.0						-50.6
S/N		106.0	107.0	108.0						-54.4

0 dB = 0.316 Vrms

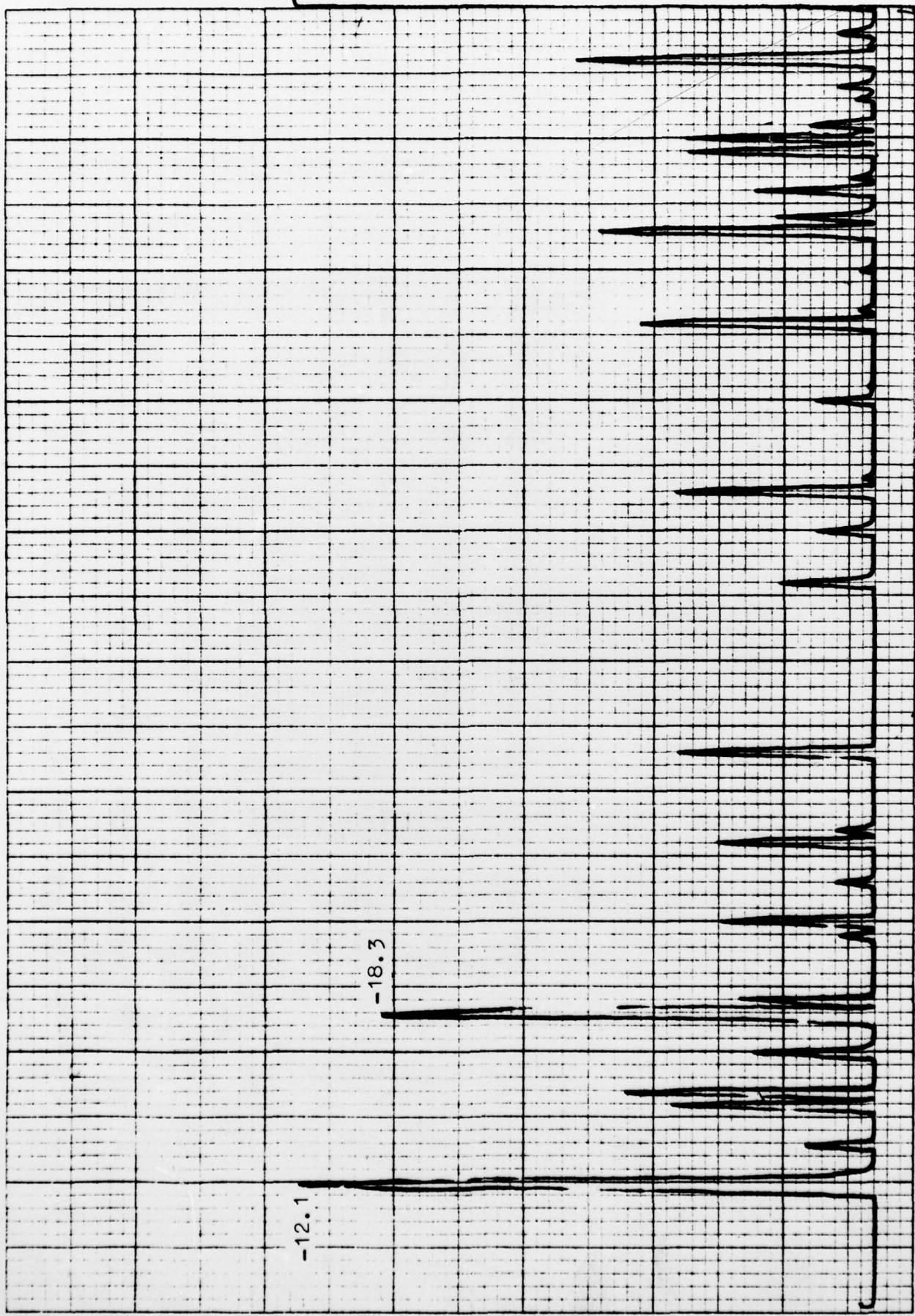
MONITOR PANEL		SPECTRUM		ANALYZER GTR (0.3 Hz BW)	
DATE 2/1/77	TIME 10 OF 10	MAIN FREQ	PUR SUP	FIRST STAGE	MAIN STAGE
SHEET 10 OF 10	BY D.A. ZJD	ATR CUR	ATR PUMP	ATTEN	ATTEN
	(TEST)	(Hz)	(psi)	(dB)	(dB)
DRIVE (VRMS) 0.004	7.0				
DC BIAS	6.0				
PRECHARGE	9.0				
OIL TEMP	10.0				
MOTOR TEMP	11.0				
WATER TEMP	12.0				
ANALYZER CORRECTIONS	13.0				
OFFSET	14.0				
SYS. GAIN	15.0				
MAIN HYDROPHONE	16.0				
TYPE	17.0				
SENS	18.0				
DIST	19.0				
SPREAD LOSS	20.0				
CORRECTED TERMINAL	21.0				
SENS	22.0				
CAL HYDROPHONE	23.0				
TYPE	24.0				
SENS	25.0				
DIST	26.0				
SPREAD LOSS	27.0				
CORRECTED TERMINAL	28.0				
SENS	29.0				
ACCELEROMETER	30.0				
CORRECTION	31.0				
FACTOR	32.0				
TYPE ANALYZER	33.0				
S/N	34.0				
	35.0				
	36.0				
	37.0				
	38.0				
	39.0				
	40.0				

DISCONTINUE TEST
OUTPUT IS NOT
CALIBRATED
AT THIS

DISCONTINUE TEST
OUTPUT IS NOT
CALIBRATED
AT THIS



Drive Level -16.1 and -16.1



Drive -16.1 and -15.7

100